

The Market Potential
for Sawn New Zealand Beech

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J. H. Thorneycroft

University of Canterbury

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ABSTRACT

Sawn timber from the species *Nothofagus fusca*, *N. menziesii*, and *N. truncata*, have wood properties that are ideal for the manufacture of furniture and other high value applications. In foreign markets sawn beech could be sold as a substitute for better known commercial timbers such as black cherry (*Prunus seratina*), red alder (*Alnus rubra*), or tropical hardwoods such as meranti (*Dipterocarp spp.*). The price of beech in the local market is similar to that of rimu (*Dacrydium cupressium*) and other native timbers. Locally produced timbers are priced significantly lower than imported timbers that have similar wood properties. In U.S. beech species might be sold 15% cheaper than locally grown hardwoods with similar characteristics, cherry, alder, and maple. Under this pricing strategy red beech would be priced at NZ\$ 775 /m³, silver beech at NZ\$ 639 /m³, and hard beech at NZ\$ 491 /m³.

EXECUTIVE SUMMARY

This study analyzed the physical characteristics and market potential for red, silver, and hard beech. From published information on the prices of commercial hardwood species the selling price for sawn beech in foreign markets is estimated. The relative attractiveness of export destinations for beech is assessed from market research and trade statistics. Drawing on the knowledge of local timber users and merchants and published information the domestic market for sawn hardwood timber is appraised.

Local manufacturers are the most attractive market for sawn beech. Much of the expensive hardwood imports used by local industry could be replaced beech. The most attractive export market is Melbourne, Australia.

S.W.O.T. Analysis for Sawn Beech.

Strengths	Weaknesses
<ul style="list-style-type: none">* Renewable resource.* Good working properties for high value applications.* Stable once dry (red, hard).* High density (red, hard).* Pleasant appearance -fine grain and distinctive figure.* Rare and unique timber.	<ul style="list-style-type: none">* Difficult to season (red, hard).* Limited quantity of high grade material.* Perceived as a low value timber.* Virtually unknown outside NZ.
Opportunities	Threats
<ul style="list-style-type: none">* Local furniture manufacturers require timber with the properties of beech.* World wide demand for appearance grade hardwoods is increasing.* Alternative products toys, musical instruments.* Manufacturers in Asia import a lot of temperate hardwood for the manufacture of furniture.	<ul style="list-style-type: none">* Cheaper softwood and non-wood substitutes.* Plantation grown hardwoods, (eg, rubberwood, mahogany).* Consumer opposition to natural grown timbers.

Prices

The price of sawn beech in the local market is higher than the price of more renowned hardwoods (eg. black cherry, red alder, or American beech) in export markets. Also, the price of imported timbers in local markets is significantly higher than the price of sawn beech of similar quality. This suggests two important things about the marketing of beech:

1. Beech is under valued in the local market.
2. The local market is over priced relative to overseas markets.

Beech is currently sold for many of the same end uses as rimu; flooring, cabinet and furniture making, and is priced as a close substitute. If the price of rimu increases due to scarcity and higher supply costs it is likely that the price of beech will rise by a similar amount. Silver and red beech 'clears' grade currently sell for between \$1200 and \$1550 /m³.

As a competition with U.S. hardwoods in foreign markets rough sawn beech 'clears' or 'FAS' grade material would be priced as follows: Red beech between \$NZ 684 /m³ and \$NZ 775 /m³; Silver beech between \$NZ 564 /m³ and \$NZ 639 /m³; and Hard beech between \$NZ 433 /m³ and \$NZ 491/m³. Lower grades would be discounted by similar amounts as in the U.S. No.1 commons at 53% and No.2 commons at 29% of the FAS price. As a substitute for tropical timbers such as keruing or meranti beech might sell between \$NZ 837 /m³ and \$NZ 950 /m³. Trial shipments would be necessary to get a more accurate estimate of export prices.

Real prices for hardwood products have increased very little in the last 20 years despite depletion of natural forest resources. It is expected that although prices may rise in the short run as markets adjust to changes in the supply of tropical hardwoods the long term increase in the price of hardwoods will be moderate.

Markets

Comparison of physical characteristics of sawn timber found that beech was similar and in some cases superior in quality to many commercial hardwoods traded internationally. This analysis relied on the quantifiable attribute of wood.

The most attractive market for beech is domestic timber users. Local timber users have knowledge of the working characteristics of beech. Here beech could be sold on its own merits rather than as a substitute for a better known timber. Labels, 'native' and 'sustainable harvest', could be a positive selling point in New Zealand.

New Zealand furniture and toy manufacturers are exported orientated so that sales of finished and semi-finished beech products will be to a wider market giving stability to the demand for the raw product.

Australian furniture industry imports of a large portion of the solid hardwood and hardwood veneer it consumes. *Nothofagus cunninghamii* 'myrtle beech' is a favoured timber for furniture manufacture in the state of Victoria. Australia is an attractive market for sawn beech and processed beech products.

The scarcity of beech relative to other commercial timbers of the world and the natural figure of red beech heartwood could be marketed to the most exclusive furniture manufacturers in rich countries. In these markets timber is not sold on its price but on demand. The reputation of a timbers unique qualities of appearance are specified by designers who are largely price insensitive. To enter this market would require a large investment in research and promotions.

Manufacturers in Asian countries are increasing their imports of U.S. hardwoods. Higher grade hardwoods of most of the popular species, red and white oak, black cherry, ash, red alder, etc. are imported mostly as rough sawn flitches, or semifinished dimension parts. Once converted into furniture a lot of this timber is re-exported to back to markets in America, Europe, and Asia. For beech there is an opportunity to substitute North American imports to manufacturers.

Further Research

Detailed research is required on the working qualities, dimensional stability, and the quantity and quality of supply of the three predominant beech species. This research will assist the marketing beech to niches with particular needs (eg. window framing for air conditioned buildings in Scandinavia or manufacture of musical instruments).

A study of New Zealand manufacturers capabilities and their timber requirements should lead to a better understanding of the wood products that should be produced from logs. The potential uses lower grade and smaller sized pieces in higher value applications could justify investment in further processing equipment.

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1. INTRODUCTION

New Zealand has a large and valuable natural resource of native hardwoods that can quite possibly be managed in a sustainable fashion to produce timber for many high value end-uses. Beech timber, despite being ideal for appearance uses and being in abundant supply, has never made it as a popular furniture or panelling wood in New Zealand. The only significant export of beech was as chips for pulp production in Australia and Japan in the 1970's and early 80's.

The logging of beech forests has now virtually ceased for environmental and economic reasons. If it were possible to overcome these problems a valuable resource might provide jobs and other benefits to the people of the West Coast, Nelson, and Southland where merchantable stands of beech forest still exist and to manufacturing industries in other provinces. Beech forests on the West Coast have been shown to regenerate to a harvestable state within a hundred years of being devastated by practices such as alluvial gold mining and ground-based logging. With modern helicopter logging and silvicultural techniques it should be possible to manage beech forests to produce quality timber in perpetuity.

Unfortunately if the only major commercial use of beech timber is pulp and paper (as many people believe) then the harvesting of beech is likely to be extremely unpopular and uneconomical. Alternative commercial processes and uses of beech, such as veneer and furniture manufacture are possible (Clifton, 1990); (Wardle, 1984). These value adding processes require appearance grade (virtually defect-free) timber which in mature beech forests is a small proportion of the standing volume. The high cost of producing appearance grade timbers from beech forests has meant that commercial ventures using beech are unattractive until a definite high value market is available for the end product. In recent years pressure on the supply of many hardwoods around the world has increased the price of wood products and may have changed the economic situation for lesser known woods such as beech.

The purpose of this report is to examine the possibilities of marketing beech timbers as medium to high value hardwood suitable for higher value 'appearance' end uses such as furniture, flooring, veneer, and structural applications such as flooring and window framing. To be acceptable in these markets it is necessary that users perceive beech as being a good substitute for the timbers they are accustomed to using for these end uses.

The potential to commercially utilise new or 'lesser-known' species concerns foresters and timber users world wide. In tropical forests especially, the amount of wood wasted by not extracting the less desirable species is sometimes 20 times as much as is extracted in the popular species (Westoby, 1988). There are hundreds of species about which very little is known and which are potentially very valuable as commercial timbers. Essential to marketing these lesser known species is reliable information on the quantity and quality of its supply (Smith and Ma, 1990). The analysis of this report on the market potential for beech is applicable to other secondary species in New Zealand and around the world.

1.1 THE PROBLEM

Timberlands Westcoast Ltd intends to put the beech forests that it administers to commercial use. The resource can be managed sustainably in economic terms given that the costs of harvesting and regenerating and managing beech forest can be covered by the sales of the products, wood and non-wood, it can produce. It is not known yet what the forest products are, possible products are diverse and range from furniture blanks to firewood to natural medicines. The most important products identifiable in this study are sawn timber, wood chips and firewood.

Whether the company develops a programme to utilise the beech forests depends largely on the price obtainable for beech wood products. This in turn is determined by economic factors such as the demand for end products, supply of alternate materials, foreign exchange rates, and stocks of timber.

To estimate with reasonable confidence what prices Timberlands can expect for their timbers I have combined information from fields of marketing, economics, wood science. Based on assessment of market conditions with simple price models, and some statistical analysis, the market value for beech emerges.

1.1.1 Statement of Problem

The purpose of this study is to estimate the market potential and price obtainable for New Zealand beech sawn timber.

Included in this goal are a number of questions:

1. What timbers is beech a substitute for?
2. How readily do markets for wood products accept substitute timbers?
3. What are the price determinants for specialty timbers?
4. Which are the most attractive markets into which beech might be substituted for recognised woods?
5. What price can beech be sold for in these markets?

1.2 LIMITATIONS

1. The obvious limitation to this study is that despite truck-loads of research on price determination, market supply and demand characteristics, and the factors affecting these crucial economic factors, there are no models capable of predicting with any certainty the price or demand of a product in the future. The estimation of prices and demands is still more of an art than a science.
2. The distinction between general purpose timbers and specialty appearance grade timbers is not made in much of the published data available for this study. The difference is very important to the marketing of beech. Beech can possibly marketed to 'exclusive' premium price furniture manufacturers, its scarcity in this situation being an advantage. There is no indication of the size and value of high value appearance markets available in publicly available sources.

3. The data on markets and prices are collected in different forms from different sources. This reduces the comparability between sets of data and limits the amount of analysis possible.

1.3 DEFINITION OF TERMS

Beech; for the purposes of this report "beech" refers to the trees and timber of the *nothofagus* species *fusca*, *menziesii*, *truncata*, and *solandri*. When referring to beech tree species from other countries they will be called by their scientific (latin) name.

Market, markets and marketing; these terms have broad meaning but refer the commercial interactions of producers, intermediaries, and users of a products or service. The marketing concept is the notion that an organisation should aim all its energies at satisfying its customers at a profit.

Product/markets; a concept used to group the issues involved in matching a single product to an identified market. This term is becoming common in marketing literature without having a strict definition.

Dimension parts; lumber manufactured to rough, semifinished, or finished parts for the manufacture of furniture, cabinets, and other items. In Australia these are known as scantlings. Dimension parts should not be confused with dimension lumber which is usually softwood lumber sawn to between 50 mm and 125 mm thick and more than 50 mm in width.

Timber; includes logs, sawnwood, veneer, and plywood. Non-coniferous is the FAO term for hardwoods (*Angiosperms*).

1.4 METHOD

Lesser-used wood species have a long history of intellectual discussion on their suitability for commercialisation (Govett *et al*, 1991). Several papers discussing the development of product/markets for lesser-known timbers are used as guides to the analysis of the market potential of beech, the most important of these are: Towler (1976), who examined the problems and opportunities of marketing lesser known timbers. Jêlvez (1991), who developed a mathematical for evaluating the substitution

potential between species. And Ekström (1991), who reviewed the marketing of red alder which until recently was itself a lesser known species.

The approach taken to identify potential markets by each of these papers is very different, economics and marketing theory are applied differently in each case. The approach taken in this report combines elements from both disciplines to suit the data available, and the time and scope of this report.

Tasks within the report were:

1. To compare the appearance and working qualities of beech to hardwoods with established markets and estimate the substitutability of New Zealand beech into these markets. Analyze the acceptability of beech as a substitute for popular "successful" timbers. This involved an analysis of wood properties, supply characteristics, market attitudes to substitution, and other competitors in timber markets.
2. To identify foreign markets and manufacturers that could a use for New Zealand beeches in their industry. An analysis of the demand and supply characteristics of these product markets and forecasts of these and other economic factors affecting the demand and price of specialist hardwoods.
3. To provide an assessment of the potential substitutability of New Zealand hardwoods relative to North American temperate and tropical hardwoods in the major Pacific Rim, U.S., Australian and European markets.

2. COMPARISON OF BEECH WITH OTHER TIMBERS

There are hundreds if not thousands of timbers that are presently not being used to their full economic potential. Many species could be better utilised in applications that are currently dominated by the popular hardwood species that are currently the staple diet of the timber industry. Beech is one of these so-called secondary, or lesser known, species.

Beech has wood properties common to many of the world's more 'successful' hardwoods (successful hardwoods are those which are commonly used in industry and are to some extent industry standards, for example oak, maple, sapele, or meranti). The attributes of hardness, fine texture, slightly interlocked grain, workability, and ability to be stained or glued make the beech timbers of the *nothofagus* species (*truncata*, *fusca*, and *menzesii*) theoretically ideal substitutes for the more expensive hardwood timber currently used in furniture, flooring, and other high value end uses.

Beech timber comes from several *nothofagus* species with similar characteristics:

- * Medium to high density hardwood (550 - 750 kg/m³ air dry);
- * Fine, even-textured wood, generally straight grain;
- * Colour ranging from yellowish white to light brown;
- * Strong and naturally durable;
- * Stable once dry;
- * Easily worked;
- * Gluing, finishing and bending properties are reasonable;
- * Attractive visual properties, wavy-heart, burls, and diverse colouring.

These attributes, common to many successful woods, are properties admired by wood users and contribute to the value of the timber (table 1). The woods chosen to compare with beech were those suggested by furniture manufacturers and timber merchants as woods for which beech might be a successful substitute.

Table 1. Characteristics of beech species and other hardwoods.

Species	Density ¹ kg/m ³	Heartwood colour	Figure ²	Texture ²	Other important features
Red Beech	630	red brown	moderate	fine	corrosive to metal fasteners
Silver Beech	585	pink brown	faint	fine	irregularity in colour
Hard Beech	745	straw to light brown	faint	fine	very stable once dry
Red Oak	770	light brown pink tinge	strong	medium coarse	furniture industry standard
Keruing	730	pink to dark brown	faint	coarse even	consists of many <i>dipterocarp</i> species
Black Cherry	580	red brown	faint some burl	fine	
Red Alder	650	pale pink brown	faint	fine even	
Beech (<i>fagus</i>)	700	white to red brown	faint	fine even	
Hard Maple	720	light red brown	faint wavy	fine even	'birds eye' defect attractive

Source: (Wardle, 1984); (USDA, 1987); (Patterson, 1975)

Notes

1. Air dry density 12% moisture
2. Descriptions of grain pattern common in timber industry. (Patterson, 1988)

In the past beech has had a wide range of uses including furniture, brush handles, and flooring. For uses where the strength and stiffness of a wood are important, such as flooring and tool handles, mechanical properties are used to describe a wood. The commonly used coefficients used to measure mechanical the mechanical strength of timbers are:

1. Modulus of rupture (MPa); indicates the maximum carrying capacity of a beam.
2. Modulus of elasticity (GPa), indicates the stiffness, or reflection characteristics of a beam.
3. Maximum crushing strength (MPa); measured parallel to the grain. Indicates the toughness of the wood.

Beech timbers, especially red and hard species, have excellent strength properties in all these coefficients (Wardle, 1984). There is, however, considerable variation according to the geographic source of the wood (*Ibid*).

2.0.1 Using Discriminant Analysis to compare beech with other hardwoods.

A model for classifying hardwood species for furniture applications in Pacific Rim markets was developed by Jêlves, Blatner, and Govett (1991). It uses discriminant analysis to identify important physical similarities between hardwoods that would suggest that one can be substituted for another. The model included several *Nothofagus* species native to Chile and found them suitable substitutes for tropical hardwoods in furniture applications.

I followed the same procedure using red, silver, and hard beech and 25 other hardwood species to determine the suitability of beech for higher value applications. The results of running the data I collected on the physical properties of 28 hardwoods in the discriminant analysis program contained in the SAS® system showed that the properties of beech were no better or worse than any of the other woods commonly used in furniture manufacture.

The procedure and results of this analysis are contained in appendix A.

2.2 CONCLUSIONS ON SUBSTITUTION

On the advice of timber experts¹ and the results of analysis of published information on wood properties and timber markets the closest timbers to beech for the purpose of pricing sawn timber are:

Red Oak, Black Cherry, Red Alder, and Hard Maple; in Pacific Rim markets.

Beech (*fagus*) and imported timbers Red Alder and Meranti; in European markets.

Rimu, and imported tropical hardwoods Keruing and Meranti; in New Zealand.

The similarities in wood properties are important to the extent that a wood must be suitable for an application, furniture making for example. In New Zealand beech and rimu, although totally different in wood properties, have similar uses (flooring, furniture, panelling) and, therefore, are almost perfect market substitutes. Currently beech timber is priced similar to rimu. If the price of rimu increases as it becomes scarcer, the price of beech may increase similarly. In foreign markets beech could also be substituted for a timber of quite different appearance and strength if the price and supply quality were attractive.

¹ Dr. Donnelly; lecturer in forest products marketing, Dr. Alf Leslie; economic adviser to the FAO., Dr. William Luppold; project leader USDA., and Mr. Alan Sayer; timber merchant.

3. MARKETS FOR BEECH

Historically beech has never been successful as a commercial timber relative to the quantity of beech forest available for management for timber production. Production of sawn timber peaked in the 1950's when about 42 000 m³ of mainly silver beech was cut in a single year. Figure 3.1 shows the importance of beech as a sawn timber relative to other native timbers. It is worthy to note that Masters (*et al*) in the National Forest Survey in 1957 estimated the total standing volume of merchantable timber at 19.9 million m³. This standing volume would convert to 8 to 10 million m³ of sawn timber given the conversion factors 40 to 50 % (Wardle, 1984).

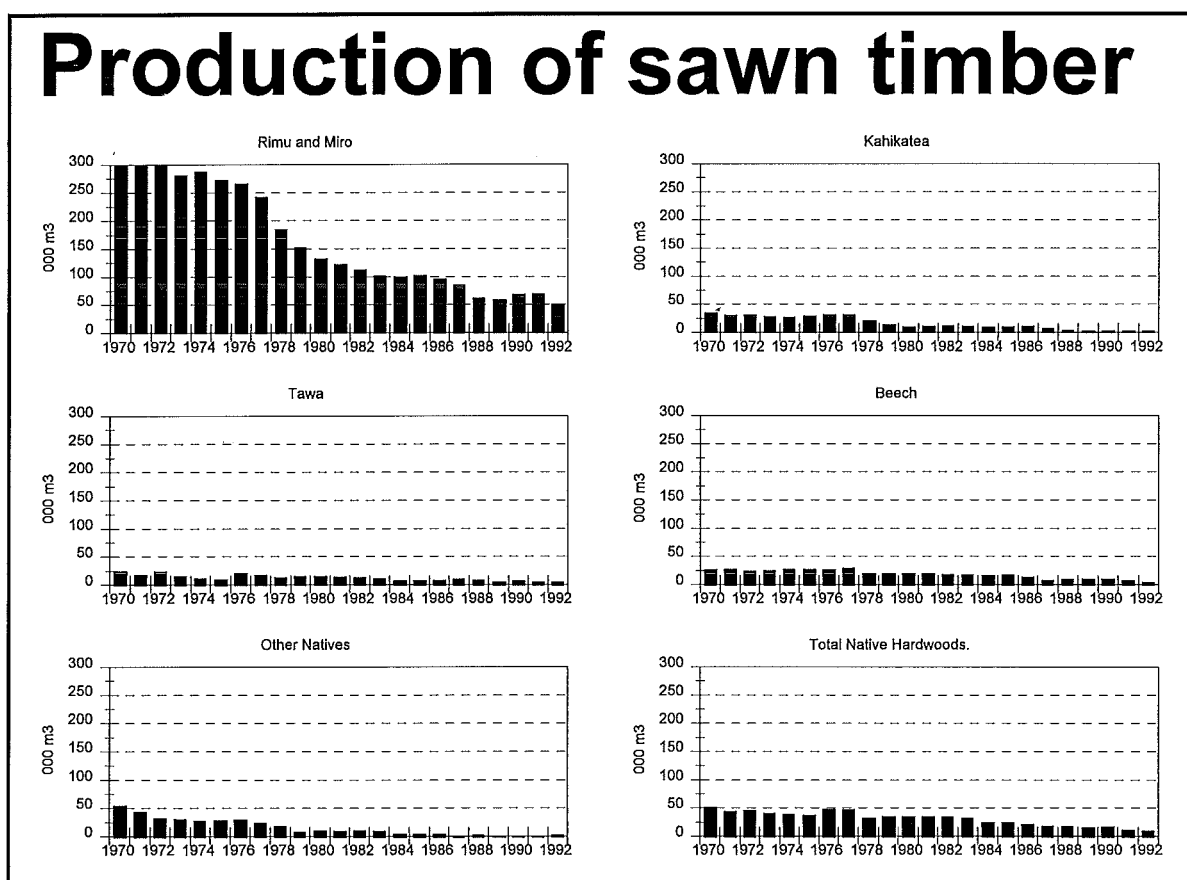


Figure 3.1 Source: Ministry of Forestry Statistics 1993

The production of sawn beech declined to just 4000 m³ reported in 1993. From interviews with timber merchants and furniture manufacturers it seems that this decline is the result of difficulty in supply of commercial quality timber rather than lack of

demand. Also, the high cost of drying beech and the low grade recovery rate has made imported sawn hardwoods more attractive to timber merchants and manufacturers. A major problem in the marketing of beech is the excess of lower grades which have no obvious use. If there is no valuable use for lower grades then the cost of producing timber must be covered by sales of appearance grade material and of by products such as firewood and chips.

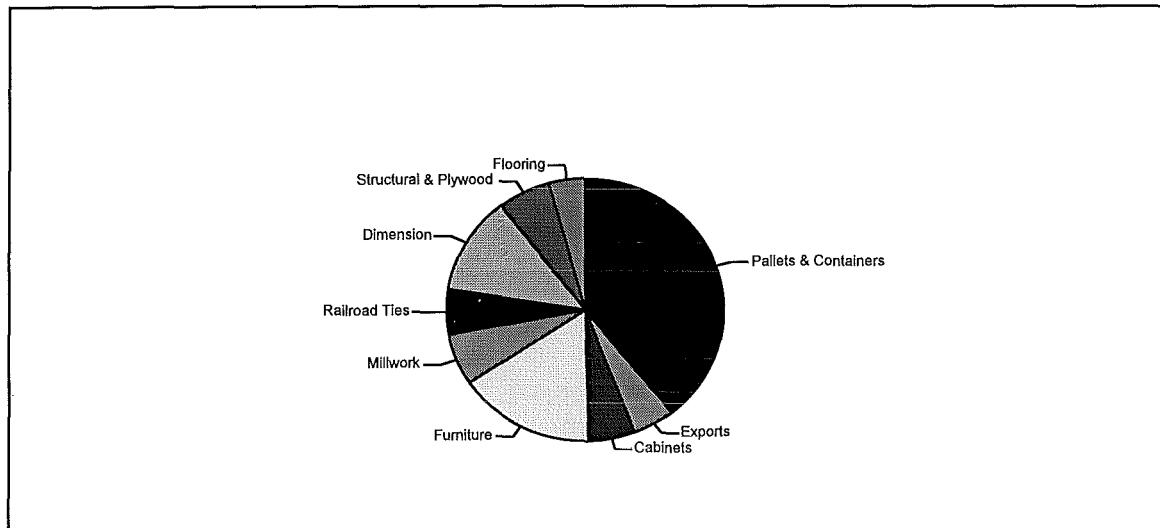


Figure 3.2. Use of hardwood lumber in the U.S. (Source: Luppold, 1989)

3.1 PRODUCT MARKETS FOR BEECH.

The variety of possible uses of beech is limited by the market opportunities (Figure 3.2). The use of hardwoods in New Zealand is similar to the situation in the U.S., Gilbert (1974) found furniture, brushware, turnery and dowels to be the main end uses for dressings grade beech. The following analysis of product/markets for beech is mostly derived from foreign literature but it should be realised that New Zealand's own timber industry is well developed and most of the opportunities that exist overseas also exist locally. The general rule of international trade is that without a solid domestic market, exporting is difficult and risky (Sinclair 1992).

3.2.1 Furniture

The furniture industry is the largest and market for user of appearance grade sawn timber and veneers (Sinclair 1992). Furniture demand determines the demand for appearance grade hardwood lumber and hardwood veneer. Through the last three decades the demand for furniture has steadily grown although the proportion of solid hardwood in furniture has declined. The main economic factors influencing the demand for furniture are the need to furnish new households and the replacement of worn-out furniture. Disposable income and unemployment rates also influence furniture purchases (*Ibid*).

Household furniture sales in the U.S. are driven by the disposable income of the consuming population. The 30 to 45 year age section of the population purchases the most furniture. This demographic group has grown both size and wealth throughout the developed world but as the 'baby-boomers' move on toward retirement furniture needs will change. Smaller, more mobile families are changing, renovating, redecorating, and refurnishing houses more often. This trend observed throughout the developed world coupled with economic growth and more consumers will continue to increase the demand for new furniture (ITC 1990).

The furniture industries all over the world are characterised by large numbers of firms making well differentiated ranges of products. In most markets generally market share is not dominated by a single firm or group of firms and competition is said to be near perfect (Nagy 1988).

Timber characteristics important to furniture manufacture (ITC 1990):

1. Colour and texture; these are particular to each furniture manufacturing region, eg. Southern Italian furniture makers like deep brown woods, mahogany, Northern Italians like a milder brown, and Danes prefer a near white or creamy coloured timber (ITC 1990). The variation in colours among pieces of wood can be used to give furniture a living appearance. Colour consistency can be achieved by staining.

2. Finishing and working properties: this is generally related to the grain of the wood. For visible timber in furniture a smooth fine finish is desirable, the timber should be easy to work. The beauty of beech in its natural colour and the ability to stain it to imitate other timbers is a marketing feature that deserves attention.

3.2.2 Hardwood Dimension Products.

Hardwood dimension wood refers to partially or fully machined parts for furniture, cabinets, and other goods. International trade in cut-to-size furniture parts requires a deep understanding of the requirements of manufacturers in foreign markets, the grade, appearance, and size parts must meet the specifications of the manufacturer and supply must be of consistent quality (Ekstrom 1991).

3.2.3 Sliced veneer

As a means of getting the most value out of an appearance timber, slicing veneer is perfect. Furniture and cabinet manufacturers are accustomed to using composite board products, plywood, and veneer covered MDF. In the U.S. the market for this type of product grew 37% by value between 1982 and 1987 (Smith and Ma, 1990). The increase since then is likely to be even greater as market pressures force manufacturers to increase the utilisation of the highest wood grades.

For decorative purposes the figure of sliced veneer is superior to peeled veneer because it more closely resembles natural lumber. The grain pattern on the back a veneer slice is the mirror image of the previous slices facing side, the effect of combining consecutive slices on cabinet faces is favoured by cabinet makers. Veneer is an ideal semi-finished product for beech. Important features of facing veneer are that it should be uniform in colour and have a tight and smooth grain.

Red and silver beech have been successfully sliced by Lumber Specialties and New Zealand Veneers in Christchurch. Problems in slicing beech have been:

1. Inconsistency in colour, red beech is preferred to silver beech because it has a thinner layer of sapwood which reduces problems of colour change between

sap and heartwood. Silver beech is also renowned for the diversity in its colouring. Inconsistent colouring is a problem because the veneer cannot always be laid so that colour changes match up. The result is an unnatural appearance.

2. Splitting of flitches. This can be controlled by steaming of flitches or logs prior to slicing. (Walker, 1993)

Because beech has a relatively straight grain flitches can be quarter or flat sliced. Alan Sayer of Lumber Specialties recommends that beech flitches should be 100 x 100 mm or 100 x 150 mm for best results.

Beech is easily stained to resemble veneers of mahogany, oak, and other high valuable woods. UDD Report 30 (Gilbert, 1974) recognises the potential for marketing beech veneer as a substitute for more expensive timbers. A manufacturer in Timaru has been successfully rotary peeling silver beech for several decades. Slices of silver beech are used for the production of such things as tooth picks, icecream sticks, and tongue depressors for medical use.

3.2.4 Wooden Toys

As an industry, wooden toy manufacture is more serious than it sounds. The trend in developed countries towards using more natural products has resulted in a heavy demand for wooden toys. The United States, Germany, and Japan, represent a \$US 300 million market whose imports amounted to \$US 150 million in 1990 (FAO Statistical Bulletin). The attraction of this market to New Zealand is its labour intensity, the high adding of value, and its high utilisation of materials.

Like furniture, developing appropriate designs may restrict local manufacturers' ambitions in this market. However, beech would be an ideal timber for toy making for several reasons; there are likely to be a lot of smaller pieces, beech works well and has a good finish when sanded, the wood is attractive, non-toxic, and aesthetically pleasing.

In the Canterbury region there are several companies manufacturing wooden toys. Telephone interviews with four of them revealed that radiata was the most used timber followed by rimu and a little silver and red beech. Native timbers were used for their colour and texture in small parts of toys. Between 0% and 40% of toys were exported to markets from Switzerland to Japan. I estimate that the entire toy industry in the Canterbury region used less than 1000 m³ of timber annually. The industry lacks the size to be a major consumer of sawn beech though may it be a useful market for smaller pieces.

3.2.5 Window framing

In Scandinavia, Northern Europe, Canada and the Northern US there is strong demand for a wood that is extremely stable once dry for window and door framing. In these countries the relative humidity of the domestic environment can range from 75% in spring and autumn to as low as 25% in the winter when central heating is in operation. This corresponds to a range of 8% to 12% equilibrium moisture content in wood. A wood suitable for window and door framing in these places must be stable in this range (ITC, 1990). The heartwood of hard and red beech are very stable once properly seasoned under normal fluctuations in atmospheric humidity. New Zealand Forest Service (1974) studies revealed that no other native timber has better dimensional stability once dry.

Dimensional stability is measured as a coefficient representing the %age of tangential and radial shrinkage and swelling in a board in a humidity range of 6% to 14%. Dimensional change coefficients for hardwoods traditionally used in window framing are given in table 3.1. The coefficients for beech were not found in published information, though it is likely that the data exists to calculate them in studies done by the UDD in the 1970's. Further research on the wood properties of red and hard beech is recommended.

Table 3.1 Dimensional Change Coefficients for Framing and Flooring Timbers.

Species	Radial C_R	Tangential C_T
Red Alder	.00151	.00256
Beech, American	.00190	.00431
Maple, Sugar/Hard	.00165	.00353
Elm	.00144	.00338
Hemlock, Western	.00102	.00237
Ponderosa pine	.00131	.00216
Iroko	.00153	.00205
Philippine Mahogany (Lauans)	.00133	.00267

(Source: USDA 1987)

3.2.6 Flooring

Exposed wooden floors require a hard and stiff timber that wears evenly without splintering. Red and hard beech have proved ideal flooring timbers in both industrial and household settings. Timber merchants claim that the most of their sales of sawn beech end up as flooring. They also emphasise the importance of ensuring the moisture of the timber to be used in flooring is appropriate to the humidity of the environment that the timber will be used in. Beech is notorious for shrinking and moving once laid because it was not dried to the correct moisture content beforehand, or because it has become damp during storage or transporting (Findlay 1975).

The use hardwoods in flooring has decreased over the last fifty years as carpets and other coverings have increased in popularity. Gymnasiums and other public venues are the major users of exposed wooden floors. Red and hard beech are ideal for flooring because their density, appearance, and price relative to other flooring hardwoods (figure 3.3).

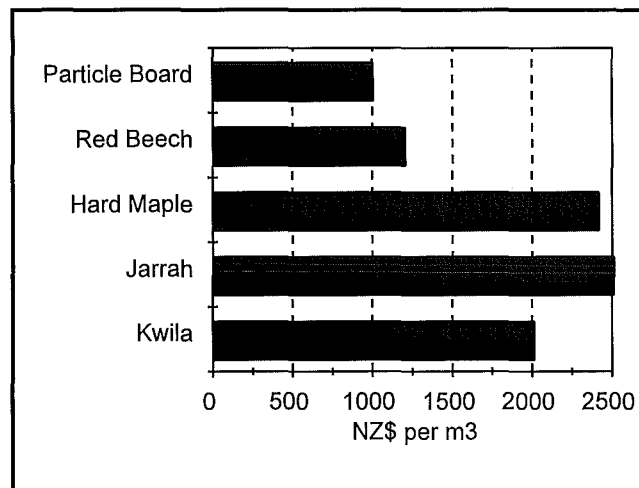


Figure 3.3 The price flooring products in the Christchurch region. May, 1994.

3.3 GEOGRAPHIC MARKETS FOR BEECH.

This review covers the markets that the author feels offer the best potential for beech.

3.3.1 New Zealand

In the past beech been used as a utility wood for railway sleepers, bridges, farm construction, flooring, joinery, turnery (millwork), brushware, and as fibre for pulp and paper. The working and appearance qualities of beech (especially silver) are recognised by many furniture manufacturers and cabinet makers in New Zealand and the demand for good grades exceeds supply.

The export markets may offer the potential for the greatest demand for specialty timbers but the domestic market should not be overlooked. The lack sawn timber available from hardwood plantations requires the importation of appearance grade hardwoods for the local furniture manufacturers (figure 3.4). The import of hardwoods has decreased since its peak of 27 000 m in 1987 but the average price of has risen to over a NZ\$ 1000 per m. The total value of imported hardwoods in 1992 was NZ\$ 16 million.

New Zealand was among the fastest growing markets for finished furniture in the 1980's (ITC 1990). This history of growing demand for high quality wooden furniture

and an economic growth rate, present and forecast, higher than the OECD average would imply that the potential for domestic timber sales is as good or better than that in foreign markets.

Timber merchants agree that there would be a high demand for red and silver beech locally if it were available. The present situation of sawn and dried silver beech being priced at roughly 60% of the price of imported equivalent timber reveals that beech is still regarded as an inferior timber by users and consumers.

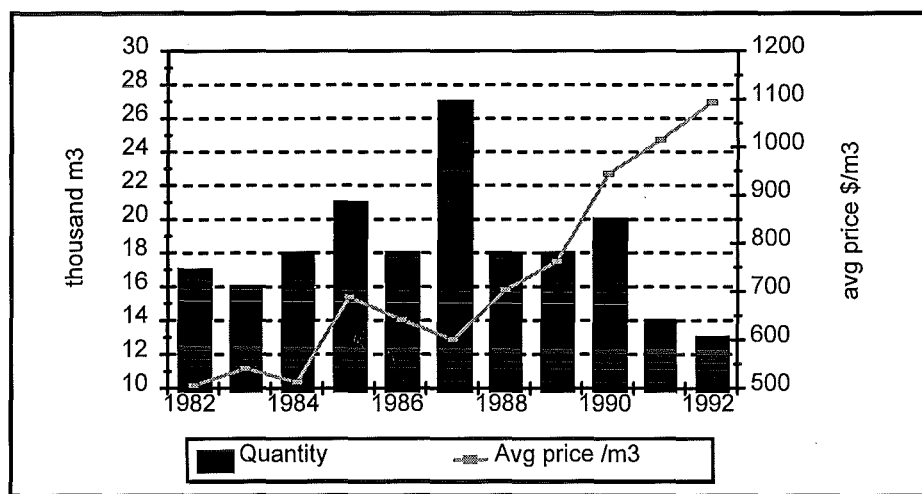


Figure 3.4 Sawn Hardwood Imports to New Zealand. (Source: MOF Statistics, 1993)

The local market is more likely to buy beech timber for the following reasons:

1. New Zealand craftspeople have experience with beech. The characteristic shrinkage, the inconsistent colouring and other defects such as pinhole are appreciated and can be used to advantage. One furniture sales person referred to a beech table as a 'living product' because it swelled and contracted with the humidity of its environment.
2. Native wood appeals to New Zealand customers. Sentimental and cultural affection with the original woods of New Zealand such as rimu and kauri could be associated with beech.

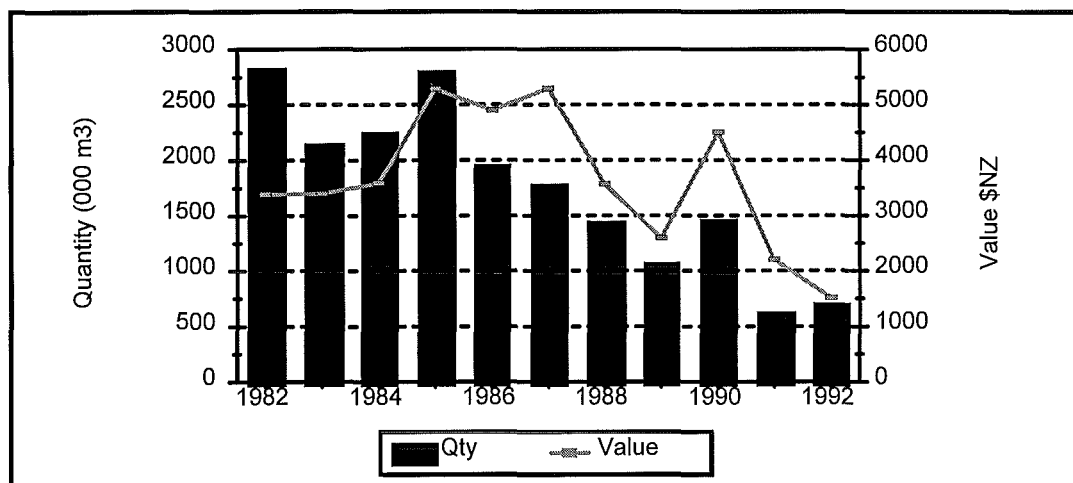


Figure 3.5. Veneer Imports to New Zealand. (Source: MOF Statistics 1993)

Imports of veneer products have been decreasing at a steady rate for the past decade (figure 3.5) but local production has stayed relatively constant. The export of veneer and plywood products has increased over the same period.

3.3.2 Australian markets.

In Victoria state, myrtle beech (*Nothofagus cunninghamii*) was considered one of the best furniture timbers available until fires in the 1928 destroyed most the standing resource. "Heritage Timber" was a brand of furniture made solely from beech and sold in the same price class as expensive imported European furniture (Leslie pers. com.). The appearance and working properties of myrtle beech are very similar to those of silver beech (Patterson 1988). Small quantities of myrtle are now supplied from Tasmanian sources. The destination and end use of this timber may be a useful start for the marketing of New Zealand beech to Australian furniture manufacturers.

Production of hardwood lumber (mostly from tropical species) in Australia decreased from 2 142 000 m³ to 1 427 000 m³ between 1980 and 1991. In the same period imports of hardwoods decreased by about 15%. As an export market for sawn beech or furniture Australia has several advantages over more distant markets; 1.) lower shipping costs, 2.) duty-free import of New Zealand products, and, 3.) more easily established trading links.

3.3.3 North America

The U.S. is the world's largest exporter of sawn hardwoods but is also a considerable importer (see figure 3.6). Generally the higher grades (FAS selects, and No. 1 commons) of red and white oak make up most exports, currently exporters are focusing on East-Asian markets as these are faster growing than traditional European markets.

The US has the potential to supply up to 25 % more hardwood than is currently being produced because the current cut is well below net annual growth. A lot of the surplus is of lower value but is quite utilisable with new technology (Araman, 1987).

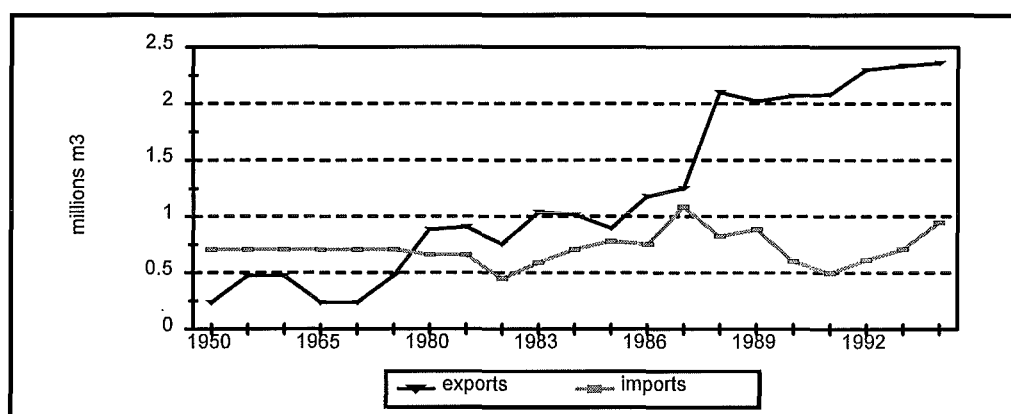


Figure 3.6. U.S. Sawn Hardwood Trade. (Source: FAO statistics, 1992)

3.3.4 Taiwan.

Taiwan is the second largest furniture exporter in the world, in 1988 they sold US\$ 2.4 billion of furniture, mostly to the US and Japan. In 1987 they imported 6 million m³ of timber, a lot of it as logs from SE Asia. Since then log supplies from Indonesia and mainland Malaysia have virtually ceased and North and South American exporters have had the opportunity to supply logs and lumber to this fast growing market (Smith and Ma, 1990).

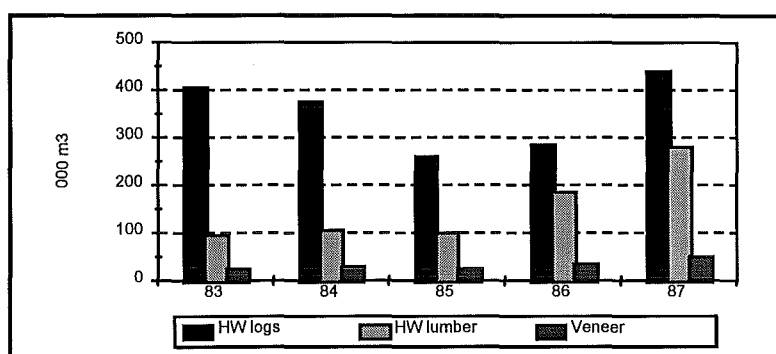


Figure 3.7 Imports of major forest products to Taiwan. (Source:FAO, 1993)

As an export market for high grade appearance lumber and sliced veneer Taiwan is very attractive. Pressure on traditional supplies of timber from the South Seas (Indonesia, Malaysia, Philippines, Papua New Guinea and other Pacific islands) has made Taiwanese manufacturers inured to using unknown timbers species (Waggener *et al*, 1990) .

3.3.5 South Korea.

South Korea is also a large exporter of wooden furniture to the US and Japan. Because of insufficient domestic supply Korea depends on imports for about 85 % of their total wood consumption and about 98.5 % of the hardwoods consumed in furniture manufacturing (Smith and Ma, 1990). Popular species for furniture are lauan, meranti and seraya from SE Asia, American exports of oak and walnut account for roughly 10% of the solid wood used in Korean furniture. Other North American timbers (maple, birch, elm, ash, and cherry) are used in small quantities but there is considerable marketing effort to by US exporters to have these lesser known species accepted as quality timbers (Govett *et al*, 1987).

3.3.5 Japan.

Despite being the world's largest importer of timber, Japan is 50% self sufficient in wood supplies. Of more importance to the potential for beech is the that 94 % of the hardwood used in furniture manufacture is imported. Demand for timber is increasing at a slow rate and is expected to continue increasing at about 2 % per annum in the foreseeable future (Jensen International, 1991).

High wage costs in the timber industry have created opportunities for greater amounts of semi-finished and finished wood products. Furniture blanks, dimension parts, veneered products and finished furniture are opportunities that beech exporters should consider. Tariffs on timber products are now all below 4% (ITTO report, 1994). Prior to the conclusion of GATT the tariffs on furniture parts were as high as 6% in some categories (Japan Ministry of Agriculture and Fisheries, 1992).

Japanese furniture is a mixture of traditional and western styles. Fashion dictates the type and style that is most marketable. Within the huge markets of kitchen, bedroom, and office furniture there are significant niches that could easily consume the entire annual cut of appearance grade beech from the South Island (even if that were over 10 000 m³). Demand for furniture is linked to housing starts and remodelling, Japanese statistics suggest that these are higher per capita in Japan than in the U.S. or Europe (MOF Statistical Release 1993).

Popular species for furniture and cabinets are nara (Japanese oak), buna (Japanese *fagus*), kabanoki (Japanese birch), and sen (Japanese ash). Red oak and red alder furniture parts imported from the U.S. have been well received by manufacturers in Japan. These substitutes for native Japanese timbers are generally used to compliment Japanese woods in low visibility uses.

The use of hardwood veneers in furniture, wall panelling, flooring, and other applications is relatively new. Furniture designs are changing to make use of veneers and new composite materials. Plywood with a core of a low value wood and hardwood facing are exported from the U.S. Inconsistency in the colouring of beech may be a problem to Japanese consumers. However, bleaching and staining of woods to give the appearance of a natural finish is acceptable.

Japanese are reputed to be conservative in their preference for native species and imports are usually sold as an imitation of a locally grown timber (Araman, 1987). A study by Waggener *et al* (1990) showed that Japanese importers were reluctant substitute lesser known timbers for the main imported species. The implications for

beech are: 1.) that it should be marketed as a substitute for a similar locally grown hardwood, eg kabanoki, (Japanese birch), and 2.) the pricing should be similar to North American hardwoods sold under similar conditions (this is covered in the next chapter).

3.3.6 European markets - in brief.

Britain is a major importer of tropical hardwoods but rising prices of tropical timbers increases the demand for substitutes. British timber users are familiar with *nothofagus procera* and *obliqua* as these Chilean beech species are grown commercially in Britain for their hardwood.

Italy is the worlds largest furniture exporter and imports roughly 3.5 million m³ of roundwood equivalent each year for furniture manufacture. Principle suppliers of roundwood are the Ivory Coast (mainly mahogany) and European neighbours (oak and beech), principle suppliers of sawnwood are Indonesia and Yugoslavia. Italian furniture manufacturers prefer brown and red coloured woods with tight grain.

3.4 NEW COMPETITION IN THE FURNITURE WOOD MARKET

A review of three hardwood industries that are relatively new to international hardwood markets.

3.4.1 Chilean beech industry.

In Chile, many *nothofagus* species are used for furniture and veneer, the most important are *N. antartica* (Rauli), *N. pumilio* (Lenga), *N.obliqua* (Roble), and *N. dombey* (Coigue). The first three have a red coloured wood, presumably similar to red beech heartwood, ciogue is between red and yellow. Rauli and Lenga are the more valuable species though prices for individual species and products were not found. The *Japan Lumber Journal* reports imports of 2463 m³ of beech logs from Chile in 1993 at a cost (c.i.f.) of US\$ 259,000, and lumber imports of 2499 m³ valued at US\$ 750,000. These rather crude figures suggest that the price paid for beech logs was roughly NZ\$ 175 /m³ and roughly NZ\$ 500/m³ for planed lumber.

According to the Chilean Forestry News (September 1991) a private company, Forostal Rusfin Ltda., recently invested \$US 6.2 million in a project to utilise Lenga timber. It plans to convert approximately 212 000 m³ of beech logs (60 % from its own forest and 40 % from suppliers) into dry lumber suitable for the manufacture of quality furniture. The product will be marketed to manufacturers of furniture and furniture components in the Chile. The addresses of several beech exporting companies are provided in appendix C.

3.4.2 Rubberwood

Over the last decade rubberwood (*Hevea brasiliensis*), a fast growing tropical plantation hardwood, has gained acceptance as a material for furniture manufacture. The tree is grown in many tropical countries but the leading technology in its silviculture and timber processing is developed in Malaysia where the tree can be rotated in 20-30 years in ideal conditions. Rubberwood is smooth, medium fine grained, and cream-coloured though it can be stained to imitate oak or mahogany. In Asian and some European furniture markets it has gained acceptance as a quality timber used in chairs and tables (either as finger jointed tops or 1.5" square profiles) and other components in structural and decorative forms.

Rubberwood is an ideal furniture timber because:

1. Its sap and heartwood are not differentiated
2. Its slightly interlocked grain and even texture resembles that of oak.
3. Although non durable and prone to sap stain and borer it is easily treated.
4. It is fast seasoning (under 10 days for a 25mm board) although splitting and warping may occur if care is not taken.
- 5 The wood can be stained, lacquered, or bleached to resemble other wood finishes from mahogany to pine (ITC 1990) .

The processing of rubberwood is widespread throughout the manufacturing industry in Taiwan, Thailand, Malaysia, and Indonesia. It has been suggested that plantation grown rubberwood could compete against radiata pine as a renewable alternative to natural forest products (ITC, 1993).

3.4.3 Red Alder. (Ekstrom, 1992)

Red alder (*Alnus rubra*) is the predominant hardwood species in the Pacific Northwest region of the U.S. Like beech it has been considered for most of history to be an inferior species because of the abundance of quality softwoods in its native area. Red Alder is fine grained, easily worked, and excellent for gluing. These features contribute to its growing reputation as an ideal substitute for more valuable hardwoods such as cherry and oak in appearance applications. Exports of began in the early 1980's and by 1991 alder made up 12 % of the total 1.14 million m³ of lumber exported from the U.S. Major export markets were Japan, Italy, Taiwan, and South Korea taking 55 %, 14 %, 10 %, and 5 % respectively. Korea is by far the largest export market for logs taking 71 %, Japan and Taiwan take 23 % and 6 % respectively. In Japan red alder is sold as a substitute for kabanoki (Japanese birch) (Araman 1987).

The price of red alder has increased steadily over the last decade, a period when other hardwood prices have changed little.

Table 3.1 Average price (\$US / MBF) increase for grades between 1985 and 1994

Grade	price 1985	price 1994	average annual increase	Inflation adjusted increase ¹
Select and Better	720	1235	72 %	38%
No. 1 common	320	670	109 %	75%
No. 2 common	240	285 ²	19 %	-15%

¹ Calculated on average annual inflation for the period of 3%

² Note: Prices for No. 2 common grade lumber were not available for the 1994 so a price was estimated by extrapolating prices 1985 to 1992.

4. HARDWOOD PRICES

Beech timber sells in retail outlets at about the same price as other native timbers, rimu and tawa. The average price around Christchurch was \$1500/m³ (rough sawn, clears) depending on the species and the source. This puts beech in the *utility* wood category of timbers. Imported tropical timbers, Fijian kauri, and Merbau (kwila), are priced at about \$2200/m³ for the equivalent product positioning them as medium value *specialty* timbers. Top grade white oak imported from the U.S. retails at roughly 6070/m³ and is classed as a high value *fine* timber.

As shown in chapter 2 beech is a relatively good wood, suitable for many high value applications. Theoretically, therefore, the market should be willing to pay a price similar to that of its competitors in the medium to high value timber market for appearance grade timber. The current perception and positioning of beech as a low value timber is partly due to a plentiful and cheap supply in the distant past and an inconsistent supply in recent years.

With the changing situation in world forestry price structures are reorganising to recognise the effects of environmental pressures, changes in demand, and freer international trade. In this new era it is difficult to predict what prices will be in the year ahead let alone in the next five years. Important impacts on the price of hardwoods follow:

1. If harvesting must be sustainable then economic costs of replacing forest should be covered by increasing the price of forest products.
2. Increased scarcity of tropical timbers should, according to economic theory, result in higher prices and substitution to alternative products.
3. Increased demand for building materials by developing countries as their populations and wealth expand will be met with technological improvements in forestry and forest products industry.

This chapter investigates the economic forces that determine the price of wood products in an international market. The prices of other hardwoods in potential markets are analysed, and an international market price of beech is estimated.

4.1 SUPPLY, DEMAND, AND PRODUCTS SUBSTITUTION

Forecasting demand and supply for wood products the long term depends on many variables that are themselves averse to prediction. Opening addresses in both the 1993 and the 1994 NZIF conferences referred to the issue of world demand and supply of wood. In the 1993 conference Dennis Neilson presented his forecast of decreasing timber supply in the Pacific Rim region. The effect of the powerful environmental movements in developed countries influencing governments to legislate against logging he predicted would create a massive timber shortage (Neilson, 1993). In the 1994 conference Don Widjiwardana acknowledged this scenario but inferred, through the research of Sedjo and Lyons (1990), that the predicted timber famine of the late twentieth century was a myth. Sedjo and Lyons predict no timber shortage to the year 2010 even if countries move to sustainable management. The conclusions reached in both cases were subject to assumptions on the behaviour of key variables, neither prediction is necessarily flawed. In this report the demand for wood is expected to follow past trends of increasing in proportion to economic and population growth, the supply situation for hardwood timber is reviewed. And the price trends of the most commonly traded species in the Pacific Rim are analysed.

4.1.1 Demand for wood products

There is general agreement that the demand for wood products will continue to increase world wide as the populations grow and economic growth gives more people the purchasing power to afford processed forest products. The world per capita consumption of wood has risen from 0.6 m³/year in 1950 to 0.7 m³/year in 1990. The trend in the U.S. is no increase in per capita consumption of all wood products, but significant increases in plywood, veneer, and pulp products (USDA 1990). Hardwood lumber consumption fell while softwood consumption rose slightly. Consumption of wood is closely related to economic growth, and housing starts. GDP growth is a good indicator of industrial wood consumption in developed regions where population growth

is negligible (figures 4.1). The wealth of an economy leads to higher disposable income for the working population and more business activity. The result is the purchase and consumption of more wood products from paper to building products.

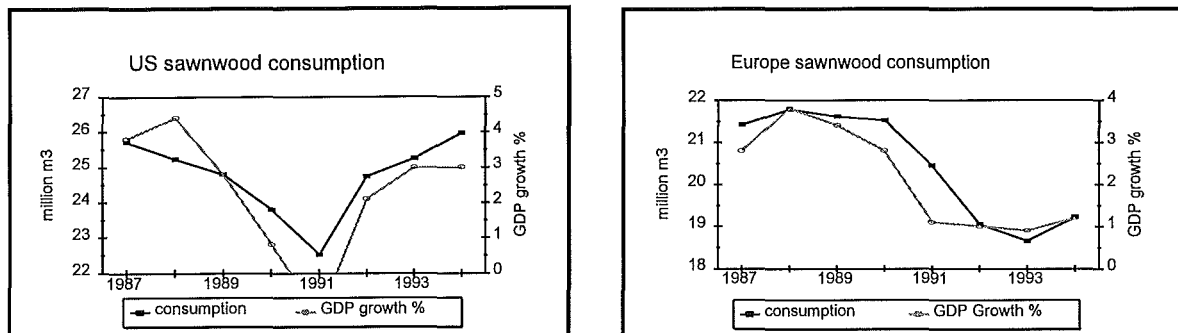


Figure 4.1 Relationship of wood consumption to GDP growth.

Steady economic growth in the world economy during the last decade has led to increased consumption of wood products. In the period 1981 to 1991 the quantity of industrial hardwood produced (and assumed to have been consumed in that period) increased at a average annual rate of 1.0%. The increase in non-coniferous sawnwood produced averaged 1.3% annually. While coniferous sawnwood production grew by about 0.6% annually. (Figure 4.2). The general trend for this period was a increased utilisation of tropical timbers and a more constant consumption of wood from temperate sources.

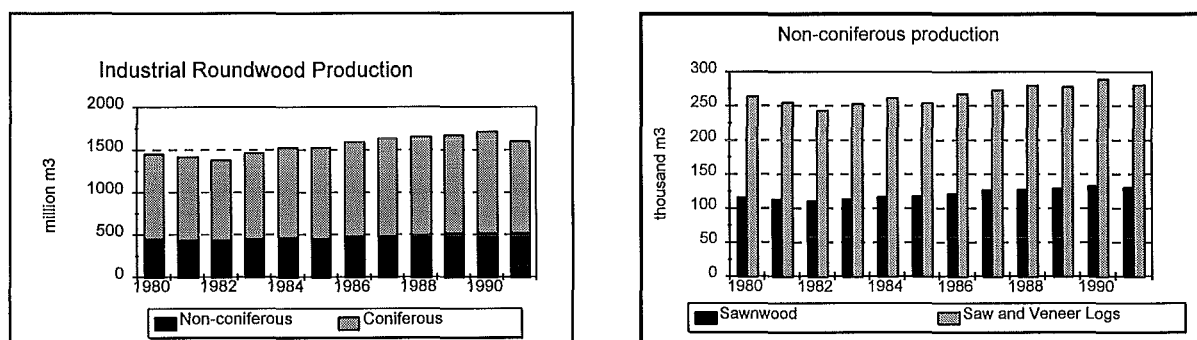


Figure 4.2 World wide wood production. (Source: FAO Statistics 1993)

As levels of income rise so does preference for appearance grade lumbers. Consumers can afford pay for better quality furniture for their larger and more

elaborate houses. Unfortunately most published statistics are very limited in the detail about the quality of wood products produced, consumed, exported and imported.

The effect of substitution between wood products and between alternative supply sources on the demand for appearance grade hardwood is unknown. The analysis of cross price elasticities in Japanese markets by Vincent *et al* (1991) suggests that a change in the price of tropical hardwoods has a very minor effect on the demand for temperate hardwoods and softwoods. The Japanese demand for timber is inelastic and substitution is slow because of business conservatism (Araman 1987) and inertia of trading links (Nagy, 1988). The issue of substitution is covered more thoroughly in section 4.1.3.

4.1.2 Supply Trends in Hardwood Producing Counties

Contrary to the widespread belief that the world's supply of hardwood timber is quickly running out, there is evidence that in Europe, the United States, and the South Pacific there is biological and economic potential to produce more hardwood timber from mixed species forests in the future. That is, the annual growth of forests is greater than annual extractions so that the stock of merchantable timber is increasing (Araman, 1986). Figure 4.3 shows the predicted world output of non-coniferous products increasing toward the end of the century.

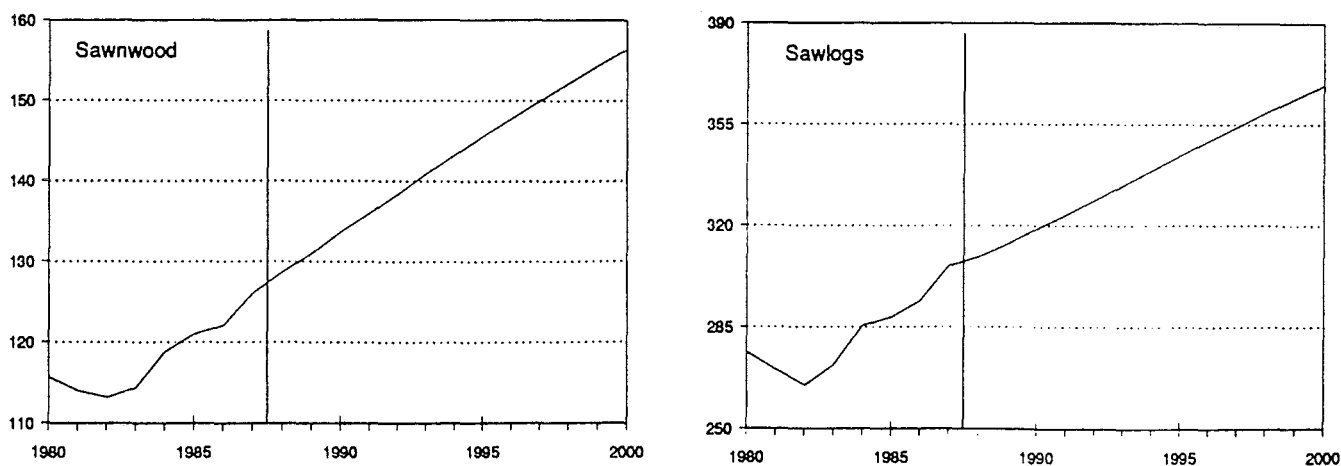


Figure 4.3 World output of non-coniferous products (million m³).

Source: Cardellicchio *et al* 1989.

In some regions there is a change in timber quality and species composition of forests. In the United States past cutting practices have led to a change in the composition of much of the harvestable forest land. The valuable species such as oaks and cherry are not regenerating as strongly as less valuable maples and ash (Fajvan¹ pers. com.). The size of harvestable logs is also decreasing and the grade outturn of sawmills is tending more towards the lower grades. The result of this change in the raw resource is the development of technologies that can utilise smaller pieces (Araman 1986).

The U.S. position as the world's largest producer, exporter, and consumer of hardwood lumber is growing (Figure 4.4). Major export destinations for hardwood lumber are Europe, Japan, and other East Asian manufacturing economies. A lot of hardwood lumber and dimension parts exported to Korea and Taiwan returns to the U.S. as finished furniture (Smith and Ma, 1990).

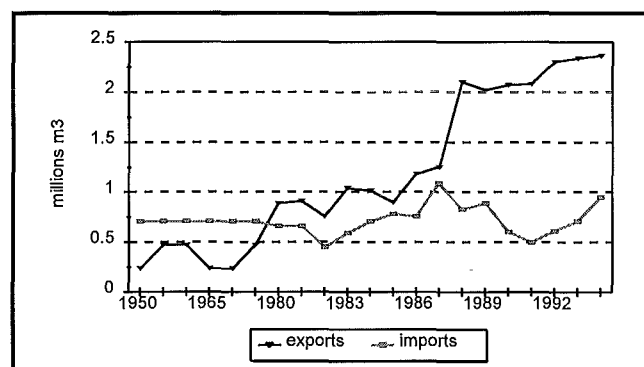


Figure 4.4 U.S. Sawn hardwood imports and exports. (Source: FAO Statistics 1993)

South Pacific

New Zealand's main suppliers of hardwood for furniture manufacturing are in the South Pacific; New Caledonia, Fiji, Papua New Guinea, Samoa, Solomon Islands, and Vanuatu. These producers have potential to increase the supply of logs, sawn timber and other wood products over the next 10 years. The South Pacific region has a healthy future as a long term supplier of tropical timbers.

¹Dr. M. Fajvan, Assistant Professor Quantitative Silviculture, West Virginia University.

The export capacity from Fiji is expanding rapidly. The annual production of sawnwood from exotic hardwoods, mainly mahogany (*Swietenia macrophylla*), is expected to reach 80 000 m³ by the year 2000, presently only 2000 m³ is sawn and exported. Tropical sawn timber exports have the potential to increase from the 18 000 m³ in 1986 to 44 000 m³ by the year 2000 the main species are Kauri and kauvula (*Agathis vitiensis* and *Endospermum macrophyllum*) (Flynn in Johnson and Ramsay, 1988). The Fijian government is encouraging foreign investment in wood processing industries. Sliced and peeled veneer, marine grade plywood, and furniture parts are likely to be major exports in the future (Asia Pacific Forest Products Journal 1994).

Papua New Guinea has a massive tropical forest resource that may be exploited to supply up to logs and wood products to the rest of Asia. The FAO in 1986, estimated that at a consumption rate of 2 million m³/yr, PNG will have 250 years supply of indigenous logs. Even with sustainable management of forests there is tremendous potential for exports from this country (Flynn in Johnson and Ramsay, 1988).

Solomon Islands, in 1988, exported 94% of its timber harvest as logs. The government plans to extract 300 000 m³/yr from forests until the year 2000. Sawn timber exports are planned to increase from 258 000 m³/yr in 1990 to 850 000 m³/yr at the turn of the century (*Ibid*).

South East Asia

The banning of log exports from Indonesia and some of the Malaysian states has resulted in more sawnwood produced by these countries (figure 4.5). Ten million m³ decline in log exports has been replaced by a 5 million m³ increase in sawnwood exports. At a conversion rate of about 50% the net export of end product is similar. The quantity of roundwood harvested has increased in Malaysia, remained fairly constant in Indonesia and decreased in Thailand, and Philippines. The net effect is an increase in the decade to 1991 of 8%.

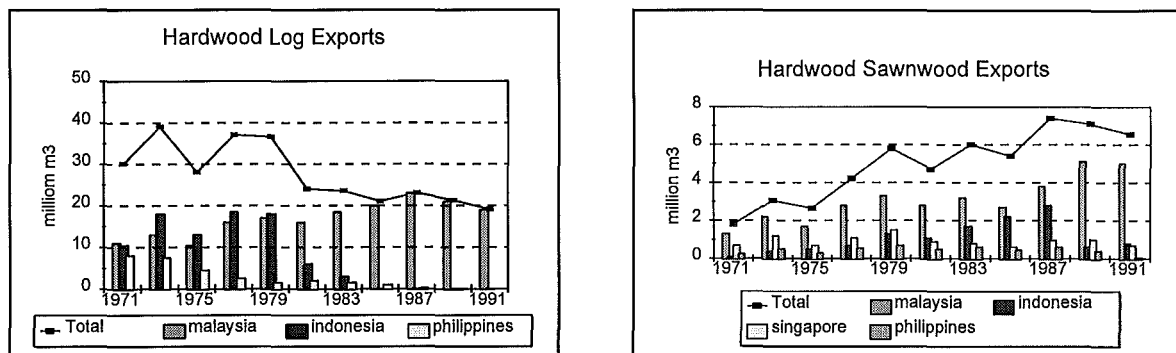


Figure 4.5. Hardwood exports from South-East Asia (Source: FAO yearbook, 1991).

I agree with Sedjo and Lyon (1990), Cardellichio (1989) and the other experts who predict that the supply will expand to meet growing demand mainly by the substitution of wood products from new species and new sources rather than by the major substitution of non-wood products, especially in appearance grade applications. The disparity between supply and demand predicted by some experts will be brief.

4.1.3 Product Substitution

Expected shortages in the supply of tropical hardwood timber can be met in a combination of the following ways.

1. Substitution of other tropical hardwood species. The utilisation of timbers in tropical forests has been estimated to be as low as 5% in Brazilian rainforests and as high as 30% in meranti rich Malaysian forests (Waggener, 1990). A vast number of potentially valuable species are not being utilised because their value is less than the cost of extraction. Freezailah (1984) and other experts agree that the physical wood properties of many of the lesser known species are as good or better than those of the popular tropical timbers.

Increased prices of popular species and technological improvements allowing the utilisation of a wider variety of timber species was expected to raise the demand for lesser known species and result in higher prices in the last two decades (Vincent *et al* 1990). Evidence collected for the period 1970 to 1987, suggests that in Japan, the price of non-dipterocarp species (representing lesser known or secondary species) did

not change significantly in relation to the price of dipterocarp species despite the large changes in timber prices and technology over the period (figure 4.4a). Despite an abundance of lesser known species with timber qualities as good or better than dipterocarp species the quantity of nondipterocarps imported was never more than 20% of dipterocarp imports (figure 4.4b). This suggests that conservative timber buyers show strong resistance to substitution of species.

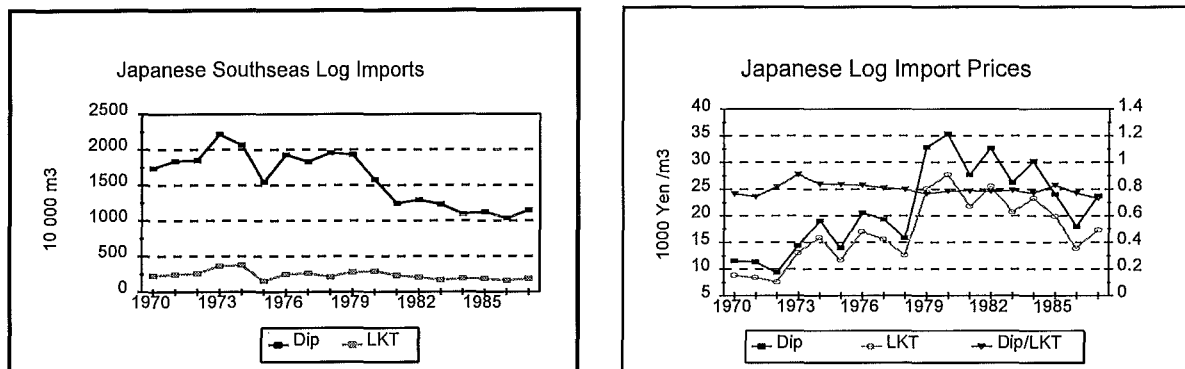


Figure 4.4a and 4.4b

2. The substitution of wood products by non-wood products. Aluminium, concrete, and other non-renewable products can be used in the place of timber in many applications. The great disadvantage of these non-renewable products is the energy required to process them. Unless a major technological breakthrough brings about methods of producing products with substantially less energy than is used at present the economical and environmental cost, of producing these products will set them outside the competition of wooden products (Buchanan, 1991).

3. Substitution of temperate hardwoods and softwoods. An econometric study of the Japanese imports found that the scarcity of tropical timber induced by deforestation and restrictive trade practices (such as Indonesia's log export ban) will lead to increased demand for temperate hardwood and softwood sawlogs (Vincent *et al*, 1991).

It is a fundamental economic principle that supply equals demand at a market-clearing price. Once the supply/demand balance is upset by a change in either, it takes time

to restore equilibrium. Forest products markets are notably slow to reach equilibrium because of low elasticity of supply. That is, if price of a product increases, because of higher demand, there is a lag in additional investment in the forest industry to produce more in response to the price rise. Generally the increase in supply will be proportionately less than the price rise (Wijewardana, 1994). A study by CINTRAFOR (1991) suggests that a 50 million m³ reduction in supply from the Pacific North West and British Columbia (as was expected under recent forestry policy changes) would be met by 40% increase in supply from within the North America, 22.5% from imports, and 37.5% from reduced demand, that is, effectively replaced by non-wood substitutes.

4.2 PRICES OF OTHER HARDWOODS

Prices of other hardwoods are a good indicator of what sawn beech would be worth outside New Zealand. A review of publicly available price information² revealed that prices for rough sawn timber in North American and Pacific Rim markets were significantly lower than the prices paid for the same product in local retail outlets (about half). Different measurements and data collection methods in different publication made comparisons of different species and market areas difficult. For example, U.S. prices were generally quoted 'f.o.b. at mill' while Japanese prices were often c.i.f. Grading systems and other inconsistencies have reduced the value of this data. It was not possible to get any good time series data for tropical timbers, the price indexes from FAO statistics show the general movement in prices over time.

² The data for comparing the prices of North American sawn wood prices are taken from the Hardwood Market Review and converted into a price in \$US per m³ using the conversion factor of 1m³ = 0.42 MBF (other conversion factors and exchange rates are provided in appendix B). These prices are collected from telephone surveys of timber merchants and the Appalachian region. The reported prices are generally used in a formula and rather than be taken at face value (Luppold, pers. com.). Prices for tropical timbers were collected from The Japan Lumber Journal, The Market New Service division of the ITTO, and the Tropical Timber News.

Table 4.2 Price movements in North American Hardwoods 1990 to 1994.

Species	Prices ³ (\$US/m ³)		Percentage Change	Average price (\$US)		
	1990	1994		FAS	No.1	No.2
tough ash	\$397	\$362	-9 %	\$351	\$227	\$99
black cherry	\$468	\$636	36%	\$545	\$321	\$164
hard maple	\$283	\$435	54%	\$339	\$229	\$145
soft maple	\$227	\$344	51%	\$269	\$195	\$125
red oak	\$411	\$483	18%	\$418	\$269	\$154
white oak	\$413	\$370	-10%	\$404	\$210	\$120
yellow poplar	\$247	\$370	25%	\$248	\$138	\$96
red alder ⁴	\$400	\$520	30%	\$445	\$235	\$120

Source: Hardwood Market Review

Graphs of lumber prices of ten North American hardwoods in the period from 1990 to the second quarter of 1994 are contained in appendix C, important features of these statistics are shown in table 4.2. The general movement over the period is positive with Maples increasing by over 50%, Black Cherry increasing by 36%, and Red Oak increasing by 20%. Inflation averaged 3% (producers price index) for that period so the deflator is about 14%, the deflator is subtracted from the *actual* price change to find the *real* price change. The hardwood price index for this period shows a significant increase in prices. This is probably the result of a cyclical upswing rather than a long term price change (Luppold pers. com.).

³ Prices of 4x4" squares rough sawn FAS grade.

⁴ Alder grade 'Select and Better'. Prices quoted for Alder are from a different source and are higher than expected.

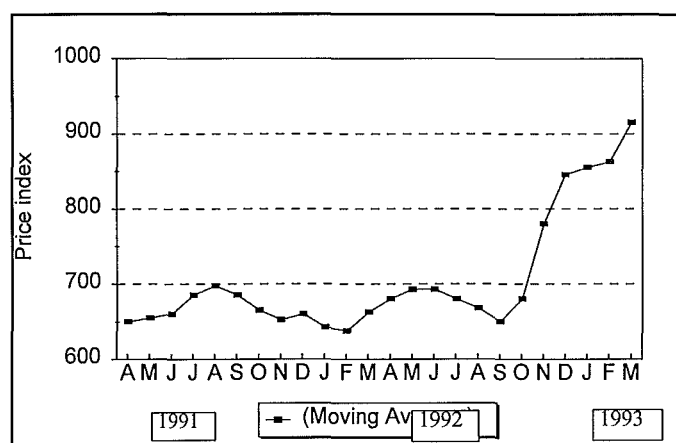


Figure 4.5. Price Index for North American Lumber. (Source:Hardwood Market Review)

Prices shown table 4.2 are for FAS grade (hardwood lumber grades are discussed in the next chapter). The differences in price between FAS and next two highest grades 'Number 1 Commons' and 'Number 2 Commons' are fairly constant between species and over the period, see graphs in appendix C. The average discount for No.1's is 53% and No.2's 29%.

Average price (\$US/m³) of rough sawn tropical sawn timbers, swietenia (mahogany), meranti, and sipo for the 1993 year, were \$836, \$760, and \$695 respectively (figure 4.6). Keruing (*Dipterocarp spp.*, secondary species included) imports to Japan were of average value \$660.

The movement in the prices of non-coniferous timber since the postwar boom of the 1950's has been similar to the prices of all wood products. With the effect of inflation taken into account the net change in prices over the period is zero (figure 4.6). Sedjo (1990) provides four hypotheses to explain this:

1. Demand for wood products levelled due to less housing starts, and the development of non-wood substitutes.
2. Wood saving technologies reduced the amount of wood required to produce the same quantity of final product, effectively reducing the demand for wood.

3. Intensive management of forests and plantations has expanded supply.
4. The harvesting of forests previously unmerchantable for technological reasons.

All four hypotheses are supported by anecdotal evidence and it is expected that the last three of these trends will continue.

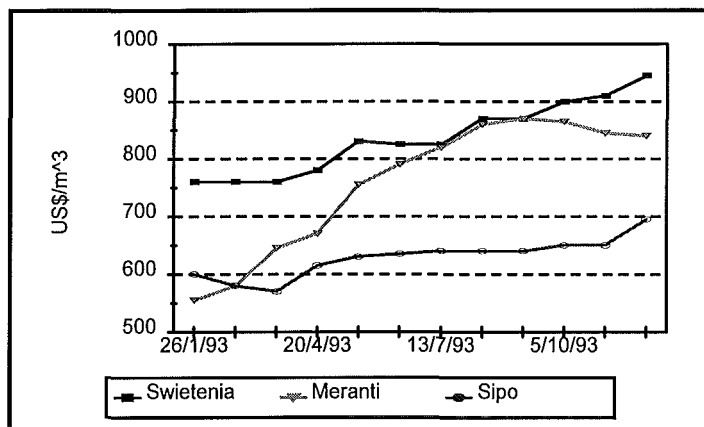
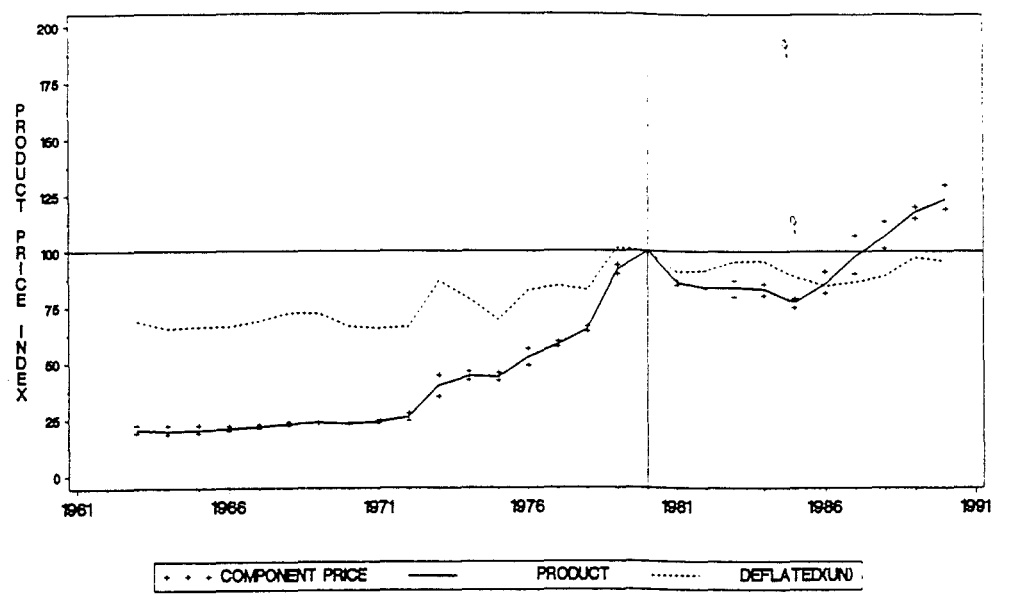


Figure 4.6 Tropical sawnwood prices, 1993. (Source: ITTO Market News Service.)

WEIGHTED PRICE INDEX
(1980=100)
TROPICAL LOGS AND SAWNWOOD



PRICE INDEX
(1980=100)
NON CONIFEROUS LOGS (TEMP. ZONE)

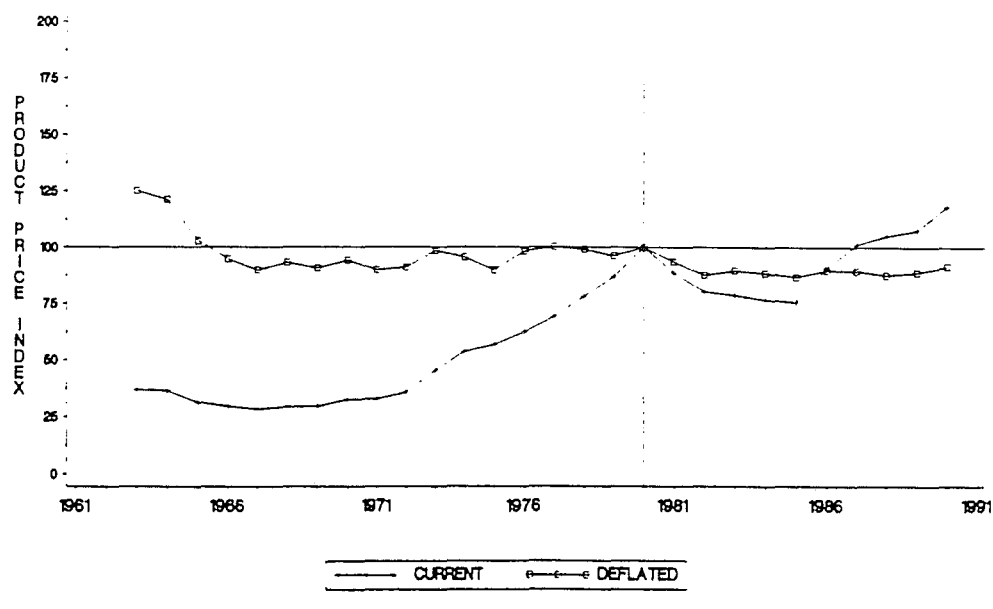


Figure 4.6 Inflation adjusted price indexes for hardwoods. (Source: FAO, 1992)

4.3 THE PRICE OBTAINABLE FOR BEECH

In the domestic timber market beech is priced as a substitute for rimu. It is likely that if the price for rimu will increase, due to increased costs of sustainable management and limited supply, the price of beech will rise by a similar amount.

In the international market place there are several possible pricing strategies for beech:

1. Market beech as a cheaper alternative to an established timber (eg Black Cherry). This would involve renaming beech as a New Zealand equivalent of the wood it is imitating, (Aotearoan Alder, Kiwi kabanoki, New Zealand Cherry). In this situation beech, the imitation, would be priced at a significant discount to the original. The percentage discount necessary to attract buyers away from the product they know to a new product is difficult to estimate. Radiata pine is traded in North America and Japan as a substitute for ponderosa and is generally priced 10% lower (Donnelly, 1992). However the end users of beech in furniture and other appearance applications are taking a large risk with a hardwood they have no experience with. The discount necessary to counter the uncertainty of the timber merchant, the manufacturer, and the ultimate consumer may be much more.

If red beech were marketed as a substitute for black cherry, silver beech as a substitute for red alder, and hard beech as a substitute for tough ash or hard maple prices would probably be 75% to 85% of the price of the original. Using the average price for the 1990 to 1994 period as a proxy for the future price of these timbers the market price for beech FAS or clears grade 4"x4" studs are:

- > Red beech between \$NZ 684 /m³ and \$NZ 775 /m³
- > Silver beech between \$NZ 564 /m³ and \$NZ 639 /m³
- > Hard beech between \$NZ 433 /m³ and \$NZ 491/m³

Lower grades would be discounted by similar amounts as in the U.S. No.1 commons at 53% and No.2 commons at 29%.

As a substitute for tropical timbers such as keruing or meranti beech might sell between \$NZ 837 and \$NZ 950.

2. Exploit the scarcity and characteristic figure of beech (more applicable to red than hard or silver beech) by selling only to the very highest quality/value/price furniture manufacturers. This approach would bypass the commodity markets and the demand and price of beech would be determined by rules and influences distinct from those that drive most other hardwood prices. Rosewood, satinwood, real mahogany, teak, and walnut are some of the few woods that are in this exclusive category of international timbers. Appendix D shows the price movements of North American hardwoods since 1990 and the price of walnut in this period has not moved in the same pattern as the other lower value timbers. Demand for exclusive timbers is virtually inelastic to price.

"Decorative products, especially those specified by architects, are sold not on price but on preference, or for their prestige value. For this reason they are unlikely to be high volume items." M. Williston. 1991

The marketing of beech as a rare and precious exotic timber for use in exclusive furniture for use only by the wealthiest consumers is an opportunity that should not be overlooked. Alf Leslie, director of the FAO forestry division in Rome for five years suggests that the cost of researching the market, preparing the product, promoting, and distributing it in European markets would be as much as NZ\$ 5 million.

4.4 FORECASTING PRICES

The several methods of forecasting and estimating prices that are available share a roughly equal amounts of credibility amongst practising experts in the fields of marketing and economics. The three methods reviewed in this study are; intuition, econometric modelling, and time series extrapolation.

The most commonly used method is basic intuition. Based on experience in the timber trade some individuals use the analytical models of thought to reckon the price

of a product in the future or in a new market. A 'jury of expert opinion' is a combination of the reckonings of a group of experts and is often used to get a deeper understanding of the market. Intuitive methods are more widely used than the more quantitative methods proposed by academic literature. They are preferred by many managers because they are naturally linked to new market information and factors not quantifiable, such as the intrinsic qualities and aesthetic appeal of a product, or the mood of buyers (Sinclair, 1992).

Econometric models are at the opposite extreme of the spectrum of technical sophistication. The use of econometrics relies heavily on massive computing power and is based on mathematic modelling of observed market behaviour. This mixture of art and science is developing rapidly in many directions but as yet it is more of an intellectual challenge than a practical tool. For this study I have reviewed the 'CINTRAFOR Global Trade Model' which, if it could forecast with any reliability would be very useful for this study.

The CINTRAFOR Global Trade Model. (Cardellichio, 1989)

This is a highly sophisticated computer model of the forest products markets in the Pacific Rim. The primary objective of this research is to assess the future outlook for forest products production, consumption, trade, and, prices in the Pacific Rim. The application of the results of this research in this report are limited because:

1. The findings are subject to many suppositions on the fundamental factors affecting timber trade. For example, the tendency of users of tropical sawlogs to switch to temperate softwood substitutes as the supply of tropical timber.
2. The forecasts provided by the CGTM deal with products in extremely broad categories. There is no distinction between temperate and tropical non-coniferous timbers.
3. The results available at present are already five years out of date. New and updated of predictions by the model should be published in 1995.

Time series extrapolation

This method assumes that a general trend in prices observed in the recent past will continue on into the near future. In times of relative certainty this might be a reasonable assumption. Unfortunately this appealingly simple method is not appropriate in times of unprecedented change. The forest products industry is going through fundamental changes in supply and demand structures that have caused uncertainty and speculation in forest products markets (CINTRAFOR 1991).

The forest products industry throughout the world has been going through a period of evolutionary transition. This transition has been dictated by changes in the raw material base, evolving global economic structures and patterns of demand, changing political processes, and an increasing awareness of environmental issues worldwide (Ibid).

This means that the patterns or trends of prices in the past are unlikely to be repeated in the future. Prices of forest products are sensitive to influences that did not exist a year ago, for example, as the sympathy of the U.S. Congress sways between commercial and wildlife interests in national forests, the prices of New Zealand forest products fluctuate wildly.

5. THE GRADING OF HARDWOOD SAWN TIMBER

Grading of timber is an essential part of the marketing strategy. Grading increases the value of timber to the buyer by assuring that the quality of the product is suitable for its intended use. The method and criteria for grading, therefore, should be determined by its intended use. The important characteristics of a board purchased for an exterior face in a piece of furniture are mainly visual, while, in a board purchased for framing appearance is irrelevant but mechanical strength must be assured in the grading system. Within appearance timber market there are grading rules for different applications, for example, the Maple Flooring Manufacturers Association (a US industry organisation) has a grading system for maple, beech, and birch flooring lumber (USDA 1987). An important point to note at this stage is that grading rules typically serve only as a starting point in lumber marketing. In the U.S. hardwood lumber producers in the export market place produce a special, or 'proprietary', export grade which assures importers that the lumber is of export quality (Sinclair, 1992).

There are several grading systems that might be used to market sawn or beech. Generally in exporting the hardwood a grading system familiar to both the importer and exporter is used. For this reason the New Zealand timber grading rules are not necessarily the appropriate grading rules for this project. Internationally the most commonly understood hardwood grading rules are those of the U.S. based National Hardwood Lumber Association.

The difference between the New Zealand Standards Association grading rules NZS 3631:1988 (see appendix D) and the NHLA rules is very important to the marketing of beech as a high quality appearance grade timber. Following is a brief description of these two grading systems.

5.1 NHLA HARDWOOD LUMBER GRADES.

The NHLA was formed in the late nineteenth century by lumbermen from all over the U.S. with the intention of establishing uniform rules for the measurement and inspection of hardwood lumber. Since then the rules have been continually developed and refined to suit the needs of the hardwood lumber market (National Hardwood Lumber Association, 1988).

The NHLA has a school for training lumber inspectors and offers an inspection service that is the final authority on the application of grades. The NHLA is a large and well respected organisation and theirs is the predominant grading system used in North America hardwood markets, also, because the U.S. is the world's largest hardwood exporter these grades are growing in their acceptance in the Pacific Rim and Europe (Findlay, 1975) . Despite acceptance NHLA grading in many of our trading partners N.Z. hardwood dealers seem to know very little about them.

NHLA grading is based on the 'Cutting Unit Method', basically this involves calculating the percentage of usable 'defect free' wood that can be cut from a board. Their area is summed and divided by the total area of the board to get a percentage of defect-free cuttings. The basic requirements of each grade are shown in table 5.1. The NHLA rules are based on the visual quality of the worst face of the board.

A step by step process of grading a board can be found in the NHLA Training Manual (1992).

Table 5.1: General requirements for NHLA factory lumber grades.

Grade	Cuttings	Width	Length
Firsts	91.67 % clear	6 inches +	8 - 16 feet (max. 15% 8 and 9 foot)
Seconds	83.33 % clear	6 inches +	8 - 16 feet (max. 15% 8 and 9 foot)
Selects	91.67% clear	4 inches +	6 - 16 feet (max. 5% 6 and 7 foot)
No. 1 Commons	66.67 % clear	3 inches +	4 - 16 feet (max. 5% 4 and 5 foot)
No. 2 Commons	50 % clear	3 inches +	4 - 16 feet (max. 10% 4 and 5 foot)
No. 3A Commons	33.33 % sound	3 inches +	4 - 16 feet (max. 25% 4 and 5 foot)
No. 3B Commons	25 % sound	3 inches +	4 - 16 feet (max. 25% 4 and 5 foot)

The grades are often streamlined for timber marketing and commonly wood is sold under the following categories:

FAS - Firsts and Seconds. Fairly long, wide boards which are clear or have a few small defects. The average manufacturer would recover between 70% to 80% from such a board (Luppold pers. com).

Select and Better - is the highest grade commonly used in the Western U.S. The average quality of a board in this grade would be slightly lower than one graded FAS.

1C (No.1 Commons) - Boards over 2 meters long with much of the surface clear of major defects. The average manufacturer would recover about 60% from such a board (*ibid*).

2C (No.2 Commons) - Relatively clear short boards or more defected large boards.

Recovery of wide and long clear cuttings difficult. Using ripping technology recovery of usable pieces can be quite large (*ibid*).

3C (No.3 Commons) - Poorer boards with some clear material. Maybe 40% recovery depending on use (*ibid*).

Other sub-grades may be used for certain species and end-use combinations.

5.2 THE NEW ZEALAND NATIONAL TIMBER GRADING RULES.

NZS 3631; 1988 rules are significantly different in their approach to timber grading. Whereas the NHLA system uses the amount of clear or sound wood that can be cut from the board the NZS 3631 grades depend on the number and size of defects in a board regardless of their distribution on the board. To manufacturers who intend to cut clear pieces from boards the distribution of defects is very important.

Unlike the NHLA system which grades boards on the worst face the NZS system uses the best side except for clears grade which is graded on both sides.

Hardwood Grades: permitted defects NZS 3631:1981

Appearance

Clears	-minimal defects, graded both sides. Suitable for cabinets and furniture where both faces are visible.
Premium	-slight defects allowed (warp, 3 surface checks, 2 pin knots). Graded best face and one edge.
Dressing	-many defects allowed (blackheart, pin hole, pin knots, woolly or raised grain.)

Structural

Engineering	-cross section of a knot or a hole must not be more than one quarter of the cross sectional area of the whole. This applies to all four faces of the board. Sloping grain less than 1 in 10
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Building -visual and structural qualities, suitable for exposed beams.

Cuttings

No.1 cuttings -Each piece must be capable of yielding cuttings of 1 meter or longer and totalling more than 2 meter. Cuttings must be of high appearance grade.

No.2 cuttings -Each piece must be capable of yielding cuttings of 0.6 meter or longer and totalling more than 1.8 meter. Cuttings must be of high appearance grade.

The New Zealand Standards Authority timber grading rule are much more complicated than those of the National Hardwood Lumber Association. This is because they covered all hardwoods grown and imported to New Zealand and do not focus on the needs of a particular group of hardwood users. The NZS 3631:1988 rules are as applicable to high quality timber for cabinet making as they are to low quality timber for pallets and packaging. The two systems do have one similarity, the requirement of the cuttings grades of NZS 3631:1988 is calculated similar to NHLA commons grades.

5.3 CONCLUSION ON GRADING RULES

For the purpose of this study the NHLA grades are the best available grading system for beech export marketing for the following reasons:

1. They are internationally accepted and understood.
2. They are suited to users of hardwoods in high value appearance applications such as furniture and cabinet making where clear wood is of utmost importance. It is these applications where the visual qualities of beech need to be recognised.
3. The grading system is relatively easy to learn and implement and the subjectivity of the inspector is minimised.

The grading rules should be a compromise between what the customer needs and what the sawmiller can produce economically. There should be provision in the selling marketing system to update the grading rules used to better satisfy both buyers and the seller. The International Standards Organisation is working on a new grading system for international sawnwood traders, if this system is acceptable to importers the it should be considered for beech lumber (Madsen, in Johnson and Smith, 1988).

The domestic market is familiar with NZS 3631 standards and most export markets are familiar with the NHLA system. The sawing for local and export markets should therefore be separated and a sawing program for each destination tailored to the needs of the customer.

6. DISCUSSION

Substitution of Beech for Tropical Timbers

The period of hardwood abundant and relatively cheap supply of hardwood logs in the South East Asia region is at its end. Malaysian and Indonesian tropical forest resources that supplied logs and sawn timber to Japan and other developed countries during the 1970's and 1980's are now supplying less wood to a wider range of manufacturers and end markets. Environmental pressure and related legislation is constricting some traditional sources of supply of hardwoods there is increased pressure for substitution by new species and alternative materials. Wood users show a willingness to try new suppliers of alternative products in order to broaden their supply source. In New Zealand and abroad manufacturers should consider beech as a potential substitute to the timber they are currently using.

Being fine grained timber and easily stained beech should fit the appearance qualities preferred by furniture manufacturers and other high-value end users (in flooring, panelling etc). Other characteristics important to manufacturers (finish, workability, durability, gluing potential, and figure) are also found in most beech but vary depending on the location of the source of beech (Wardle, 1984).

Attractive substitutes are not always similar to those presently used for a particular purpose. In many cases the wood used for a purpose is not perfectly suited for the job. For example, keruing is used for flooring in Britain but has a high degree of movement once laid, this is not a good property in flooring. A superior substitute for keruing may be quite different in physical characteristics (Towler, 1976).

Red and silver beech have both been proven to be good furniture woods and theoretically can be positioned as a substitutes for the high value temperate timbers of the Northern Hemisphere. Timbers that are closest to red beech in physical characteristics are cherry, and European beech. Soft maple and red alder are similar to silver beech in appearance.

To be supply successful substitute to an existing timber it is important that new supplier can deliver consistently in the most suitable form, size and quality. Colour, strength and other physical properties are not as important as the quality of supply. Ekstrom (1992) surveyed the opinions of exporters of hardwood lumber in Washington State (U.S.). His conclusion was that after pricing and appearance the most important factors to customers were the ability to provide; 1. kiln-dried lumber, 2. accurate grading, 3. high quality, and 4. planed or surfaced lumber. Of least importance were custom cutting and ability to provide a variety of species. Reputation of the mill and customer relations were also rated as important to exporting.

Pricing

Pricing is a perplexing problem to intellectuals and practitioners of economics of even the highest rank. Pricing is termed a 'natural' system and, therefore, difficult to analyze mathematically. Major difficulties in the modelling of market forces and pricing are:

1. Present prices incorporate speculation on future prices ('intertemporal behaviour' Cardellechio 1989).
2. Deals are negotiated at arms length and not publicly.
3. Prices may be subject to long term contracts, distorted by trade barriers and subsidies.
4. Experts with real knowledge on prices keep it to themselves.

The existence of an 'international market' for wood products is debatable. Although regional and local markets move in the same general patterns/directions there are movements and opportunities unique to each. Transport costs and trade barriers (including language, tariffs, and grading systems) give regional and local markets unique behaviour. Another issue to consider is the balance of supply 'push', and demand 'pull' in the timber trade and its influence on the pricing mechanism. The

mood of the market determines whether buyers take the 'best offer' from market sellers or sellers accept the 'best offer' from market buyers.

The 'holy grail' of many economists is the building of a realistic market model. Such a model, if possible, will need to quantify the interrelationships of a myriad sometimes qualitative factors. The models available at present provide a useful framework for analysing markets but are not renowned for their predictive capability.

In the short term prices are quite volatile, fluctuations are caused by changes in demand related to normal business cycle of boom and recession economy. The sharp rise in hardwood prices since mid 1993 is associated with the recent growth in the US economy, furniture sales are closely linked to disposable income and housing changes which are in turn dependent on a healthy economy. There is also sometimes seasonal change caused by harvesting difficulties due to weather which tightens supply driving up prices.

The prices for forest products in North America are much lower than in New Zealand. This is due to the efficiency of the more intense competition in a larger market and the plentiful supply of timber from the continent and abroad. Pricing at or slightly below the Hardwood Market Review reported prices for North American Cherry, Alder, Maple, etc beech would see beech sold for less than its present low price in the local market (see section 4.2 and 4.3).

Markets

New Zealand is an isolated market dependent on imports of hardwood to supply manufacturers. Imports of sawn hardwood amounted to 14 000 m³ compared to 9000 m³ produced locally in 1992 (MOF, 1993). The price of hardwood timber in a New Zealand retail outlets is almost double that of the equivalent product in the U.S. The International Trade Centre (UNCTAD/GATT) identified New Zealand as the fastest growing market for imported wooden furniture in the decade to 1989.

The pricing of beech as in a foreign market as a substitute for traditionally accepted

hardwood such as black cherry or meranti will require a significant discount to compensate for the uncertainty of new buyers. New Zealand manufacturers are generally more aware of the qualities and problems of beech and might be more inclined to replace their expensive imports with a local products if the supply was available. Local manufacturers may be willing to pay more than foreigners -an unusual situation in export marketing.

The attitude of New Zealand manufacturers to beech is that they would use it more if it were available. UDD report 65 (Vaney, 1979) found that Auckland furniture manufacturers preferred silver and red over hard beech but found that all suitable for their production. Informal interviews of several furniture manufacturers in the South Island confirmed that properly seasoned beech was an excellent timber. Many would use beech if more was available. Further research to identify the needs and capabilities of local manufactures would be relatively inexpensive and would increase the awareness of users of the possible increased availability of beech. If secondary manufacturing of beech is done locally and finished or semi-finished products are exported the marketing of the sawnwood is both less expensive and less risky.

Asian countries Japan, China, Korea, Taiwan, Hongkong, and Singapore are big importers of hardwood for furniture manufacture. Often the furniture is re-exported to a wide range of markets from Germany to India. These countries are outside the markets generally targeted by New Zealand exporters giving the products a greater coverage. Joint ventures with manufacturer/exporters in East Asia would give manufacturing opportunities and market access not possible in the local economy. More than a third of all exported hardwood from the U.S. ends up in Asia and over 55% of red alder exports are to Japan (Araman, 1987 and Ekstrom, 1991).

Marketing

Relative to other commercial timbers of the world the quantity of beech available is very small. James Haas, a lumber importer in California (MoF ,1994) reckons that in the U.S. radiata pine lumber is beginning to be sold on its own merits rather than as a substitute for ponderosa due to the large increases in imports in the last couple of

years. In a large market beech will always be bought as a substitute, reputation and customer loyalty will difficult to build and changes in supply or prices of other hardwoods vulnerable to changes in market conditions.

Instead scarcity should be used to advantage. Beech is marketed as a 'prestige' timber suitable for the highest value end uses. Identifying and selling to exclusive niche markets is an opportunity that should not be overlooked.. If beech could be marketed as an rare exotic timber to the very highest value markets in Europe or North America the sawn clear wood could be priced as high as that of *fine* timbers rosewood, satinwood, and teak.

Opportunities that would not be difficult or expensive to research and trial are markets such as Victoria, Australia where, 'beech' (myrtle beech, *Nothofagus cunninghamii*) was a well known and respected timber for furniture and cabinet work until supply ran out. In New Zealand the 'indigenous' label could be applied positively to sustainably managed beech.

Properties of beech, acoustics, potential for wider range of specialty applications or niche markets, window frames. Niche market opportunities are not revealed in published information and must be researched by personal contact.

'Trading link inertia' (ie resistance of buyers to change supply sources) can be overcome with investment in promotions, market research, developing more suitable products for customers, joint ventures, and selling finished or semi-finished products.

7. CONCLUSIONS

7.1 Beech Sawn Timber

Beech forests are a renewable resource. Timber can be harvested perpetually if ecologically sound management practices are employed.

Beech timber is suitable for furniture, cabinet making, toys, other appearance uses, and structural purposes such as flooring and window framing. In these applications beech is an ideal substitute for other temperate and some tropical hardwoods.

The supply of beech is very small compared to other commercial hardwoods. Production of sawn timber is never likely to exceed 20 000 m³ annually. Of this 50% or less is unlikely to be suitable for appearance grade timber.

Seasoning of hard and red beeches is expensive and difficult. This is not uncommon amongst hardwoods.

7.2 Hardwood Markets

Prices of imported hardwoods in New Zealand markets are considerably higher than New Zealand beech which is priced similar to rimu and tawa.

Targeting the local market is likely to be less expensive and less risky than foreign markets.

Australia is the most attractive export market as it is the least expensive to enter and has a furniture industry that is familiar with beech.

Furniture manufacturers in Japan, Korea, Hongkong, Taiwan and Singapore are trying North American hardwoods as alternatives to decreasing supplies of tropical timber. These markets offer opportunities for sawn beech or semi finished furniture parts.

There is no world wide shortage of merchantable hardwood. Demand for wood products will grow slowly as it has since 1950. The demand for appearance wood products has grown faster.

Substitution between hardwood species, between hardwoods and softwoods, between solid wood and composite products, and between wood and non-wood products is increasing.

Technological improvements and capital investment in the forest industries will increase the supply of wood products.

7.3 Pricing

In the domestic market beech is priced similar to rimu (\$1200/m³ to \$1500/m³ for clears grade). The price of beech sawnwood is likely to increase as the rimu becomes scarcer.

Internationally the gradual appreciation of hardwood prices in the last decade is likely to continue. There may be short term fluctuations caused by economic/business cycle and supply/demand disparity as markets adjust to new conditions, eg. environmental policy, timber certification issues, GATT.

If red beech were marketed as a substitute for black cherry, silver beech as a substitute for red alder, and hard beech as a substitute for tough ash or hard maple they would probably sold at 75% to 85% of the price their American counter-parts.

FAS or 'clears' grade 4"x4" studs of beech would be priced:

- > Red beech between \$NZ 684 /m³ and \$NZ 775 /m³
- > Silver beech between \$NZ 564 /m³ and \$NZ 639 /m³
- > Hard beech between \$NZ 433 /m³ and \$NZ 491/m³

Lower grades would be discounted by similar amounts as in the U.S. No.1 commons at 53% and No.2 commons at 29%.

As a substitute for tropical timbers such as keruing or meranti beech might sell between \$NZ 837 and \$NZ 950 in international markets.

7.4 Grading Rules

The grading rules should be a compromise between what the customer needs and what the sawmiller can produce economically. NHLA grades are the best available grading system for beech export marketing. For the domestic market the NZS 3631 rules are generally used.

7.5 Future research

1. The physical properties of beech timber require further analysis to define their suitability for a wider range of specialty applications or niche markets. For example, acoustical properties for musical instruments, or dimensional stability for window frames.
2. The usage and capacity to increase usage of hardwood by local manufacturers should be surveyed. A study of end products will indicate the products that are required by manufacturers.
3. Alternative uses for lower grade sawn timber and chip wood. For example, could beech branches and off-cuts be used in MDF or OSB plants.

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APPENDIX A

The use of discriminant analysis to compare the properties of beech with those of other hardwoods.

Discriminant analysis is a commonly used marketing tool, though the power of complex statistical techniques such as this are "*extremely dangerous when used by unskilled people*" (Kinnear and Taylor 1979) because of the statistical assumptions associated with them. Aware of these dangers I set out to try this model for myself.¹

The model involved characterising a selection of commercial timbers in a numerical form. Ordinal rankings were used to describe the wood properties considered important to furniture manufacturers and other timber users. Colour, finish, texture, workability, durability, treatability, and ease of gluing were found to be the most important and also readily available in books. These attributes were given a number ranking for each species of wood. The numbering system can be seen in table 2.

¹ (Not without taking precautions of course, assumptions were made and multi-directional unilateral disclaimers were uttered with academic zeal).

Table 2. *Coding of the different properties for hardwood species.*

Classification:	Code:
Colour	
Whitish, pale brown, pale yellow or straw	1
Dark brown	2
Pink or red tints, including red brown	3
Other colours (black, purple, etc.)	4
Durability	
Very durable	1
Durable	2
Moderately durable	3
Nondurable	4
Perishable	5
Treatability	
Permeable	1
Moderately resistant	2
Resistant	3
Extremely resistant	4
Finishing	
Excellent	1
Good	2
Fair or medium	3
Texture	
Close or fine	1
Medium fine	2
Medium coarse	3
Coarse	4

Classification:	Code:
Colour	
Whitish, pale brown, pale yellow or straw	1
Workability	
Very good or excellent	1
Easy or good	2
Poor or difficult	3
Gluing	
Excellent	1
Good	2
Fair or satisfactory	3
Strength	
Low	1
Medium	2
High	3

(Source: *Jelvez et al. 1991*)

Twenty-eight hardwood species most commonly used in the Pacific Rim countries and North America were used for classification purposes. The assignment of species to groups is a key step in the model development and is somewhat subjective. The groups chosen, based on the market value of the woods, were high value *fine* timbers (group 1), medium value *specialty* timbers (group 2), and low value *utility* timbers (group 3). The choice of groups suited an analysis of sawnwood timber markets. A more quantitative grouping system would have been preferred.

First the timbers with a known international market value, that is the non-New Zealand timbers are assigned to a group, then, using discriminant analysis the New Zealand timbers in the study are fitted to the group with which they have the most in common.

Table 3. The analysis of hardwood timbers using discriminant analysis.

Timber	G ¹	C.	Properties ²						
			T.	W.	F.	G.	D.	T.	S.
Red Beech	?	3	1	1	1	2	2	1	2
Hard Beech	?	1	1	2	1	2	2	4	1
Silver Beech	?	3	1	1	1	1	3	1	2
Myrtle Beech	2	2	1	2	2	2	4	2	2
European Beech	2	1	1	2	1	1	5	1	2
American Beech	2	3	1	2	2	2	4	1	2
Black Cherry	2	3	1	1	1	1	3	2	2
Japanese Birch	2	3	1	2	1	1	4	2	1
Chilean Beech	3	3	1	2	2	2	3	2	2
Oak, White	1	1	3	2	2	2	2	4	2
Oak, Red	1	2	3	2	2	3	4	2	2
Oak, European	1	1	3	2	1	2	2	4	2
Oak, Japanese	1	1	3	1	1	1	2	1	2
Ash, Japanese	2	1	4	2	2	2	1	2	2
Ash, European	2	1	4	2	1	2	4	3	2
Ash, American	2	1	4	2	2	2	4	1	1
Aspen	3	1	2	2	3	3	4	4	3
Elm, American	2	3	4	2	2	2	3	2	2
Elm, English	1	1	4	3	2	2	4	2	3
Maple, Rock	2	3	1	3	2	2	2	3	1
Walnut	1	2	2	2	1	3	1	3	2
Iroko	2	1	4	3	1	2	1	4	2
Meranti, Dark	2	3	3	2	2	2	2	3	3
Meranti, Light	2	3	3	2	2	2	4	3	2
Keruing	2	2	3	3	2	3	3	2	1
Teak	1	2	4	2	3	2	1	4	2
Mahogany, Af.	1	3	2	2	1	2	3	4	3
Mahogany, Am.	1	3	3	1	1	2	2	4	3

Notes:

1. **G** represents the initial grouping for the timber, beech species groups (?) were to be the outcome of the programme.
2. The properties initials (C,T,W,F,G,D,T,S) correspond to the property codes in table 2.

2.1.2 Results

After running the programme several times using different parameters and statistical significance levels it was concluded that the properties described in the table had little or no influence on the value of a timber.

That is:

Statistically, beech could not be assigned to a value group on the property rankings given in tables 2 and 3.

The analysis was inconclusive for several reasons:

1. The analysis used ordinal data in a program suited to interval data.
2. The properties chosen for analysis were obviously not the essential discriminating properties that determine the market value of a wood. (It is possible to run another program to identify which of the variables are more and less critical but the results of this would be no more reliable than those given by common sense.)
3. There were not enough woods represented in the medium and low value groups of hardwoods (groups 2 and 3).

The benefits of this analysis are not so obvious but relevant all the same:

1. The result that describable physical properties (such as colour, texture, workability) are not the most useful in determining a woods value. A more qualitative approach might be more appropriate.
2. The mapping of wood properties showed that beech is as suitable as any other wood based on these attributes.

APPENDIX B

Addresses of over twenty exporters of Chilean beech products are available in the Chilean Forestry News publication, November 1991.

These are the two largest exporters listed in that publication:

Agricola y Forestal Bagaro Ltda.
Franklin 360
PO Box 447-3
Santiago.

General Manager: Luis Basauri
Export Manager: Ricardo Garcia
Fax:(56-2) 551 4045

Forestal Anchile Ltda.
Marchant Pereira10
Santiago.

General Manager: Kasundri Kihara
Fax: (56-2) 232 5069

APPENDIX C

Conversion factors used in this report

Units of measurement for sawn timber

Unit	Solid Volume Equivalent		
	(m3)	(cu.ft)	(1000 bd ft)=Mbfm
m3	1.00	35.31	0.42
cu ft	2.86×10^{-2}	1.00	1.20×10^{-2}
1000 board feet	2.36	83.33	1.00
load	1.416	50	0.60
Pstd	4.670	165	1980

Exchange Rates

For the past year the New Zealand dollar has appreciated against the currencies of our main trading partners.

Exchange rates over the year to May 1994 (Source: Reserve Bank of NZ)

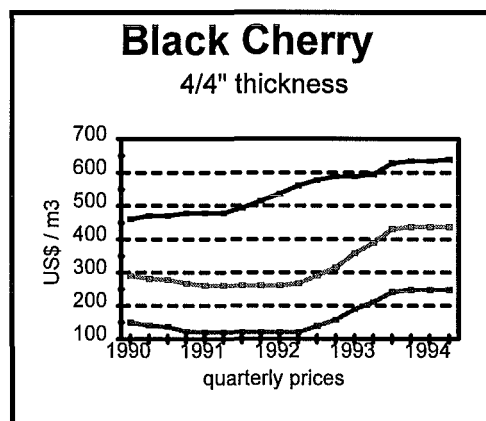
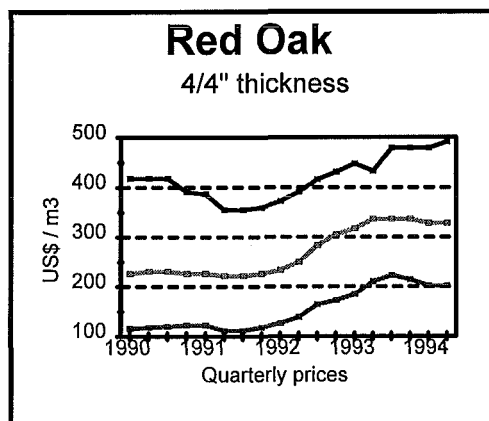
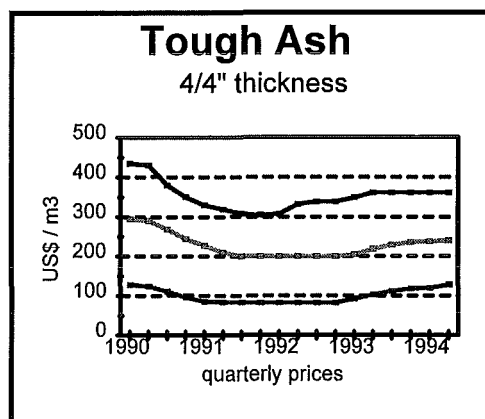
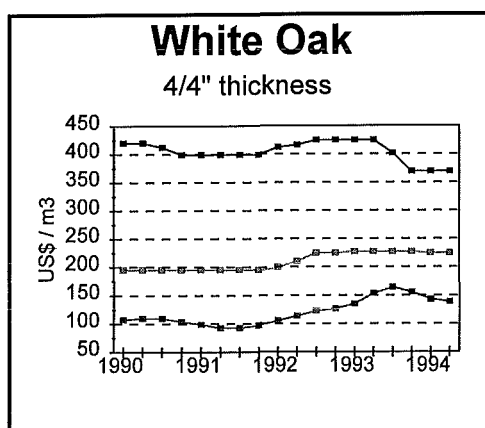
	5/93	8/93	11/93	2/94	5/94
US \$	54.3	55.2	54.5	57.7	58.7
UK £	34.3	37.0	36.6	38.8	38.9
Au \$					
JP ¥ (100)	58.2	57.3	59.5	60.5	60.7

Appendix D

Prices of other timbers.

The U.S. lumber trade is well supplied with information on the prices of the main forest products in the US market. The prices shown below are only the quoted prices from telephone surveys done by the Hardwood Market Review. (Actual transaction prices are not available).

The following graphs are based on the prices for 4"x 4" rough sawn lumber f.o.b. from the sellers yard. The top line refers to FAS grades (see chapter 6), the middle line refers to number 1 commons grade, and the lower indicates the quarterly price of number 2 commons -the lowest of the NHLA appearance grades.



3

GROUP II : HARDWOODS (NATIVE, NEW ZEALAND GROWN EXOTIC AND IMPORTED)

3.1

Clears grade

3.1.1

Permitted defects

3.1.1.1

In any piece the following defects only shall be permitted on *either* face or edge:

Cup	as given by table 4.
Gum streaks	(a) one (b) 5 mm wide (c) 100 mm long
Sloping grain	1 in 10
Stain	insufficient to impair a natural finish
Surface checks	(a) three (b) 0.5 mm wide (c) 50 mm long

3.2

Premium grade

3.2.1

Permitted defects

3.2.1.1

In any piece the following defects shall be permitted on the better face and edge:

Collapse	insufficient to affect the dry-dressed dimensions
Gum streaks	(a) 5 mm wide (b) sum of lengths 300 mm
Pin knots	two
Sloping grain	1 in 10
Stain	insufficient to impair a natural finish
Surface checks	(a) three (b) 0.5 mm wide (c) 50 mm long
Warp:	
Bow	as given by table 2
Crook	as given by table 3
Cup	as given by table 4
Twist	as given by table 5

3.2.1.2

In accordance with 1.3.2 the reverse face and edge may contain defects permitted by 3.3.1 Dressing Grade except as follows:

Wane 5 mm on face edge

3.3

Dressing grade

3.3.1

Permitted defects

3.3.1.1

In any piece the following defects shall be permitted on the better face and edge:

Blackheart	not restricted
Collapse	insufficient to affect the dry-dressed dimensions
Gum pocket	(a) 3 mm wide (b) sum of lengths 100 mm
Gum streaks	(a) 10 mm wide (b) sum of lengths 300 mm
Pin hole	four
Pin knots	not restricted
Stain	insufficient to impair a natural finish
Sloping grain	1 in 10
Surface checks	(a) three (b) 0.5 mm wide (c) 50 mm long
Tight bark pocket	(a) 6 mm wide (b) sum of lengths 100 mm
Warp:	as given in table 2
Bow	
Crook	as given in table 3
Cup	as given in table 4
Twist	as given in table 5
Woolly or raised grain	5% of surface area

3.3.1.2

In accordance with 1.3.2 the reverse face and edge may contain any defects except as follows:
Wane 10 mm on the face or edge

3.4

Engineering grade

3.4.1

Permitted defects

The defect limitations for Building grade shall apply to Engineering grade also. In addition to these requirements, the following restrictions shall also apply:

- The projected area on the cross-section of any knot, knot group or hole appearing partially or wholly within the margin region of the piece shall not occupy more than one quarter of the margin cross-sectional area. (In the case of squared members, this restriction will apply to all four faces. See fig. 21.)
- Sloping grain 1 in 10.

3.4.2

Branding

3.4.2.1

Each piece of Engineering grade shall be legibly branded on a face at one end of the piece and in letters not less than 10 mm high with "NZS 3631E" provided that by agreement between vendor and purchaser the brand may be omitted.